IBM Magstar 3590 Tape Subsystem

Hardware Reference

GA32-0331-03

IBM Magstar 3590 Tape Subsystem

Hardware Reference

GA32-0331-03

Note

Before using this information and the product it supports, be sure to read the general information under “Notices” on page 245.

Fourth Edition (September, 2000)

This edition of the *IBM 3590 High Performance Tape Subsystem Hardware Reference*, GA32-0331-03, obsoletes and replaces GA32-0331-02. Changes or additions are indicated by a vertical line in the left margin.

The following paragraph does not apply to any country where such provisions are inconsistent with local law.

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions; therefore, this statement may not apply to you.

Order publications through your IBM representative or the IBM branch office serving your locality.

If you have comments or suggestions to improve this book see “Do You Have Comments or Suggestions?” on page 245.

When you send information to IBM, you grant IBM a non-exclusive right to use or distribute the information in any way it believes appropriate without incurring any obligation to you.

© Copyright International Business Machines Corporation 1996, 2000. All rights reserved.
US Government Users Restricted Rights – Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

Contents

Figures vii

Preface ix
Organization ix
Related Information ix
IBM 3590 Publications ix
IBM 3494 Tape Library Dataserver Publications ix
IBM 3495 Tape Library Dataserver Publications ix
RS/6000 Publications x
AS/400 Publications x
Related Software Information x

Summary of Change xiii
Fourth Edition xiii
Third Edition xiii
Second Edition xiii

Chapter 1. Introduction 1
Highlights 1
Exceptional Performance 1
Improved Reliability and Integrity 2
Wide Platform Connectivity 2
High Capacity 2
Cost Effectiveness 2
Ease of Use 3
Service 3
3590 Models 3
Storage Management Software 3

Chapter 2. Drive SCSI Commands 5
Drive SCSI Commands Listed Alphabetically 7
Control Byte Definition 9
Change Definition -X‘40’ 10
Display Message -X‘C0’ 12
Erase -X‘19’ 15
Inquiry -X‘12’ 16
Inquiry Standard Data: Valid LUN (Logical Unit Number) 16
Inquiry Standard Data: Invalid LUN 19
Inquiry Page X‘00’. 21
Inquiry Page X‘03’: ASCII Information 22
Inquiry Page X‘80’: Unit Serial Number 23
Inquiry Page X‘83’: Device Identification. 24
Load Unload -X‘1B’ 26
Locate -X‘2B’ 28
Log Select -X‘4C’ 30
Log Sense -X‘4D’ 32
Log Page Format 32
Log Parameter Format 33
Log Page X‘00’: Supported Log Pages 35
Log Page X‘02’: Write Error Counters 36
Log Page X‘03’: Read Error Counters 38
Log Page X‘06’: Non-Medium Errors 40
Log Page X‘0C’: Sequential-access device. 41

© Copyright IBM Corp. 1996, 2000

Log Page X'31': SIM/MIM 43
Log Page X'32': Write Errors 47
Log Page X'34': Read Forward Errors 51
Log Page X'36': Read Reverse Errors 58
Log Page X'38': Blocks/Bytes Transferred 59
Log Page X'39': SCSI Port 0 Interface Errors 63
Log Page X'3A': SCSI Port 1 Interface Errors 65
Log Page X'3B': Equipment Check Errors 66
Log Page X'3D': Subsystem Statistics 69
Mode Select (6) - X'15' 74
Mode Parameter List for Mode Select (6) 76
Mode Parameter Header for Mode Select (6) 77
Block Descriptor for Mode Select (6) or Mode Select (10) 78
Mode Select (10) - X'55' 79
Mode Parameter List for Mode Select (10) 81
Mode Parameter Header for Mode Select (10) 82
Mode Sense (6) - X'1A' 83
Mode Parameter List for Mode Sense (6) 84
Mode Parameter Header for Mode Sense (6) 85
Block Descriptor for Mode Sense (6) or Mode Sense (10) 86
Mode Sense (10) - X'5A' 88
Mode Parameter List for Mode Sense (10) 89
Mode Parameter Header for Mode Sense (10) 90
Mode Page Format 92
Move Medium -X'A5' 126
Persistent Reserve In - X'5E' 127
Persistent Reserve Out - X'5F' 129
Prevent Allow Medium Removal - X'1E' 130
Read - X'08' 131
Read Block Limits - X'05' 133
Read Buffer - X'3C' 134
Magstar Drive Buffers 135
Read Element Status - X'B8' 137
Read Position - X'34' 138
Read Reverse - X'0F' 141
Receive Diagnostic Results - X'1C' 143
Diagnostic Results Page Formats 143
Recover Buffered Data - X'14' 145
Release Unit - X'17' 146
Report Density Support- X'44' 147
Report LUNs - X'A0' 150
Request Sense - X'03' 151
Reserve Unit - X'16' 158
Rewind - X'01' 159
Send Diagnostic - X'1D' 160
PF (Page Format) 160
SelfTest 160
DevOfL (Device Off Line) 160
UnitOfL (Unit Off Line) 161
Parameter List Length 161
Flag and Link 161
Diagnostic Page Formats 162
Magstar-Supported Diagnostics 162
Self-Test 164
Change SCSI ID Diagnostic 165
POST A Diagnostic 167

POST B Diagnostic . . . 169
ACF Diagnostic . . . 171
Force Dump Diagnostic . . . 173
Write Dump to Cartridge Diagnostic . . . 174
Create FMR Cartridge Diagnostic . . . 176
Set Traps Diagnostic . . . 178
Remove Traps Diagnostic . . . 179
Set Drive Parameters Diagnostic . . . 180
Reset VSARS Diagnostic . . . 181
Reset Drive Diagnostic . . . 182
Space - X‘11’ . . . 183
Test Unit Ready - X‘00’ . . . 184
Write - X‘0A’ . . . 185
Write Buffer - X‘3B’ . . . 186
Write Filemarks - X‘10’ . . . 187

Chapter 3. ACF SCSI Commands . . . 189
ACF SCSI Commands Listed Alphabetically . . . 190
Initialize Element Status - X‘07’ . . . 192
Inquiry - X‘12’ . . . 193
Inquiry Page X‘00’ . . . 193
Inquiry Page X‘80’: Unit Serial Number . . . 194
Inquiry Page X‘83’: Device Identification . . . 194
Log Sense - X‘4D’ . . . 196
Log Page ‘00’: Supported Log Pages . . . 196
Mode Select (6) - X‘15’ . . . 197
Mode Parameter Header for Mode Select (6) . . . 197
Mode Select (10) - X‘55’ . . . 198
Mode Parameter Header for Mode Select (10) . . . 198
Mode Sense (6) - X‘1A’ . . . 199
Mode Parameter Header for Mode Sense (6) . . . 199
Mode Sense (10) - X‘5A’ . . . 200
Mode Parameter Header for Mode Sense (10) . . . 200
Mode Page Format . . . 201
Move Medium -X‘A5’ . . . 202
Position to Element - X‘2B’ . . . 203
Read Element Status - X‘B8’ . . . 204
Element Status Data . . . 205
Element Descriptors . . . 207
Receive Diagnostic Results - X‘1C’ . . . 213
Release Element (6) - X‘17’ . . . 214
Request Sense - X‘03’ . . . 215
Reserve Element (6)- X‘16’ . . . 216
Data Format of Element List Descriptors . . . 216
Send Diagnostic - X‘1D’ . . . 217
Test Unit Ready - X‘00’ . . . 218

Chapter 4. ACF Modes of Operation . . . 219
ACF Notes . . . 219
Initiator Control of the ACF . . . 220
Manual Mode . . . 221
Accumulate Mode . . . 222
Automatic Mode . . . 223
System Mode . . . 225
Random Mode . . . 226
Random 2-LUN Mode (B-Series Models Only) . . . 228

Cell Status Indicators 229
Cell Status: Flashing Yellow is an Attention Indicator 229
Cell Status: Steady Yellow Indicates Alert Conditions 229
Cell Status: Steady Green is an In-Use Indicator 229

Appendix A. SCSI Protocol Implementation Notes for the Magstar 231
Device Messages 231
Supported SCSI Status Codes. 232

Appendix B. Error Sense Information 233
Sense Key 0 (No Sense). 233
Sense Key 1 (Recovered Error) 233
Sense Key 2 (Not Ready) 233
Sense Key 3 (Medium Error) 234
Sense Key 4 (Hardware Error). 234
Sense Key 5 (Illegal Request) 235
Sense Key 6 (Unit Attention) 235
Sense Key 7 (Data Protect). 236
Sense Key 8 (Blank Check). 236
Sense Key B (Aborted Command) 236
Sense Key D (Volume Overflow) 237

Appendix C. Implementation Considerations 239
Scaled Log Page Counters 239
SCSI-ID and LUN Assignments 239
Multiple Port Behavior 239
Behavior with Auto-Share Disabled 240
Behavior with Auto-Share Enabled 240
Data Transfer, Block Limits, and Fixed Block Option 241
Cleaning the Drive in the 3494 Library 241
Drive Cleaning Indicators. 242
Operator Panel Cleaning Indication 242
SCSI Interface — Dynamic Cleaning Indicators 242
SCSI Interface — Static Cleaning Indicator (Sense Data Byte 70). 243

Notices 245
Do You Have Comments or Suggestions? 245
Terms 246
Trademarks. 246
IBM Agreement for Licensed Internal Code 247
Actions You May Not Take 247
AIX License Information Additional Terms and Conditions 248
Communication Statements 249

Glossary 251

Index 255

Figures

1. IBM 3590 Model B11 Rack-Mounted Tape Subsystem 1

© Copyright IBM Corp. 1996, 2000

Preface

Organization

The information in this book is presented as follows:

- Chapter 1. Introduction, describes the subsystem.
- Chapter 2. Drive SCSI Commands, describes the SCSI commands supported for the Magstar drive (LUN 0). These commands include support for the Magstar ACF when addressed as an Attached Medium Changer device at LUN 0 (1-LUN addressing).
- Chapter 3. ACF SCSI Commands, describes the SCSI commands supported for the Magstar ACF when addressed as an Independent Medium Changer device at LUN 1 (2-LUN addressing).
- Chapter 4. ACF Modes of Operation, describes the seven ACF modes of operation.
- Appendix A. SCSI Protocol Implementation Notes for the Magstar, describes the SCSI protocol implementation choices.
- Appendix B. Error Sense Information, provides all error sense information reported by the Magstar devices.
- Appendix C. Implementation Considerations, describes the SCSI implementation considerations.
- The “Glossary” on page 251 describes words and terms used in this book.
- The “Index” on page 255 includes keywords and terms to help retrieve information in this book.

Related Information

IBM 3590 Publications

For additional information about the 3590 subsystem, refer to:

- *IBM Magstar 3590 Tape Subsystem Operator Guide*, GA32-0330
- *IBM 3591 Tape Control Unit Model A01 Introduction, Planning, and User's Guide*, GA32-0358
- *IBM Magstar 3590 Tape Subsystem Introduction and Planning Guide,* GA32-0329
- *Magstar 3590 Tape Subsystem Silo-Compatible Frame Models C12 and C14 Introduction, Planning, and User Guide*, GA32-0366
- *IBM General Information Installation Manual—Physical Planning*, GC22-7072

IBM 3494 Tape Library Dataserver Publications

For additional information about the 3494 Tape Library Dataserver, refer to:

- *IBM 3494 Introduction and Planning Guide*, GA32-0279
- *IBM 3494 Operator's Guide*, GA32-0280
- *IBM 3494 Physical Planning Template*, GX35-5049
- *IBM 3494 User's Guide: Media Library Device Driver for AS/400*, GC35-0153

IBM 3495 Tape Library Dataserver Publications

For additional information about the 3495 Tape Library Dataserver, refer to:

- *IBM 3495 Tape Library Dataserver Introduction and Planning Guide*, GA32-0234

© Copyright IBM Corp. 1996, 2000

- *IBM 3495 Tape Library Dataserver Models L20, L30, L40, and L50 Operator's Guide*, GA32-0235

RS/6000 Publications

For additional information about RS/6000® systems, see:

- *RISC System/6000 Getting Started: Using RISC System/6000*, GC23-2521
- *RISC System/6000 Getting Started: Managing RISC System/6000*, GC23-2378
- *RISC System/6000 Problem Solving Guide*, SC23-2204
- *RISC System/6000 V4 Problem Solving Guide*, SC23-2606
- *RISC System/6000 V4 Message Guide & Reference*, SC23-2641
- *RISC System/6000 Planning for System Installation*, SA38-0508
- *RS/6000 7017 Rack Installation and Service Guide*, SA48-0548

AS/400 Publications

For additional information about AS/400® systems, see:

- *AS/400 Physical Planning Guide and Reference*, GA41-9571
- *AS/400 Control Language Reference*, SC41-0030
- *AS/400 Service: Service Functions*, SY44-3902
- *AS/400 System Operation*, SC41-3203
- *AS/400 Physical Planning Reference*, SA41-3109
- *AS/400 Physical Planning Summary*, SX41-3108
- *AS/400 Control Language Reference*, SC41-0030
- *AS/400 Security Concepts and Planning*, SC41-8083
- *AS/400 System/370™ Connectivity*, GG24-3336
- *Automated Tape Library Planning and Management Guide*, SC41-3309

Related Software Information

For information regarding software related to the IBM 3590 Tape Subsystem, refer to:

- *AIX/ESA Diagnosis Guide*, SC23-3079
- *AIX/ESA Device Driver Developer's Guide*, SC23-3085
- *AIX Parallel and ESCON Channel Tape Attachment/6000 Installation and User's Guide*, GA32-0311
- *Basic Tape Library Support User's Guide and Reference*, SC26-7016
- *Environmental Record Editing and Printing (EREP) Program User's Guide and Reference*, GC28-1378
- *DFSMS/MVS Version 1 Release 1: General Information*, GC26-4900
- *DFSMS/MVS Version 1 Release 1: Object Access Method Planning, Installation, and Storage Administration Guide for Tape Libraries*, SC26-3051
- *DFSMS/MVS Version 1 Release 1: Object Access Method Application Programmer's Reference*, SC26-4917
- *DFSMS/MVS Version 1 Release 1: Guide and Master Index*, GC26-4904
- *Multiple Virtual Storage/Enterprise System Architecture Library Guide for System Product*, GC28-1601
- *MVS/ESA Storage Management Library: Storage Management Reader's Guide*, GC26-3122

- *Virtual Machine/Enterprise System Architecture Library Guide and Master Index*, GC24-5518
- *Virtual Machine/Enterprise System Architecture Library Guide and Master Index for System/370*, GC24-5436
- *Virtual Machine/Enterprise System Architecture General Information*, GC24-5550
- *IBM SCSI Tape Drive and Library Device Drivers Installation and User's Guide*, GC35-0154

Summary of Change

This summary of changes includes specific release updates to this book.

Fourth Edition

This release includes information on the 3590 Extended High Performance Cartridge Tape and Fibre Channel Attachment. Extended High Performance Cartridge Tape increases both the IBM Magstar 3590 E Model 256-track serpentine format capacity to 40GB and the IBM Magstar 3590 B Model 128-track serpentine format capacity to 20GB. This release includes information on Fibre Channel Attachment features. With Fibre Channel Attachment, 3590 Model E is now capable of delivering a data rate of 40 MB/sec maximum sustained data rate (with 3:1 data compression) and up to 100 MB/sec maximum instantaneous data rate. Fibre Channel Attachment has increased the maximum distance to 500 meters. It is possible to extend the maximum distance to 10 kilometers using fibre components.

Third Edition

This release includes information on two new Magstar 3590 tape drives, Models E1A and E11. With these models, the native data transfer rate is improved by more than 50% and cartridge capacity is doubled to a 256-track serpentine format. Models E1A and E11 can read and write data in the 256-track serpentine format, and both Exx and Bxx models read data in the 128-track serpentine format. Model Bxx tape drives write in the 128-track serpentine format.

Second Edition

This release includes information on the Magstar Ultra and hardware feature additions.

© Copyright IBM Corp. 1996, 2000

Chapter 1. Introduction

The IBM Magstar 3590 High Performance Tape Subsystem provides new levels of function, performance, reliability, and cartridge capacity.

Figure 1 shows a 3590 tape subsystem.

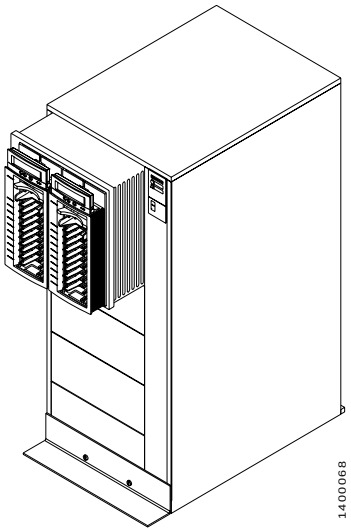

Figure 1. IBM 3590 Model B11 Rack-Mounted Tape Subsystem

Highlights

- Magstar 3590 attaches to selected systems, including Hewlett-Packard, Sun Microsystems, HP/Convex, CRAY Research, Inc., Silicon Graphics, Intel-based systems running Windows NT and Windows 2000, as well as to IBM AS/400, RS/6000, and S/390 systems.
- The Magstar 3590's 13.5 MB/sec native data rate (33MB/sec with maximum compression) dramatically reduces backup and recovery times.
- With random access to 1200 GB of data (3:1 compressed), the Magstar 3590 10-cartridge Automatic Cartridge Facility (ACF) functions as a low-cost mini-library.
- Magstar 3590's 5 meters/sec high-speed search provides rapid access to stored data.
- Magstar 3590 cartridges can contain 120 GB with 3:1 data compression.
- The Magstar 3590 tape drive is designed for up to a 100-fold increase in data integrity over the 3480.
- The Magstar 3590 E-series models also offer a dual 100 MB/sec Fibre Channel Port option for increased performance and connectivity.
- Dual Ultra/Wide differential SCSI ports provide enhanced sharing capabilities

Exceptional Performance

The Magstar 3590 models have leading-edge streaming and start/stop performance. This is important since most applications operate in start/stop mode. The 3590 E-series streaming performance is more than four times that of the 3490E, with a native data transfer rate of 13.5 MB/sec (40 MB/sec with 3:1 compression). The maximum instantaneous data rate is 40 MB/sec on an Ultra/Wide SCSI Interface.

© Copyright IBM Corp. 1996, 2000

The Magstar 3590 E-series models have a maximum instantaneous data rate of 100 MB/sec with the Fibre Channel Attachment option.

Improved Reliability and Integrity

The advanced Magstar 3590 tape drive is designed for up to a 100-fold increase in data integrity over the 3480. Magstar 3590 uses a bidirectional serpentine recording technique and a second-generation magnetoresistive head that writes 16 data tracks at a time. Improved Error Correction Code (ECC) and servo tracks written on tape help ensure data integrity. Resident diagnostics monitor operations to detect potential problems and aid in fast resolution.

Wide Platform Connectivity

The Magstar 3590 has two Ultra/Wide differential SCSI ports, allowing the drive to be shared in a multi-platform open systems environment.

Data can be interchanged across a wide range of platforms with the Magstar 3590 Tape Subsystem. The Magstar 3590 attaches to selected systems from Hewlett-Packard, Sun Microsystems, HP/Convex, CRAY, Silicon Graphics, Sequent, and Intel-based systems that support Windows NT and Windows 2000, as well as to IBM AS/400, RS/6000, and S/390 systems.

The Magstar 3590 E-series Models have a Fibre Channel Attachment option, allowing Fibre Channel Attachment to selected RS/6000, Intel-Based systems that support Windows NT and Windows 2000, Sun, and NUMA-Q systems.

High Capacity

Magstar 3590 Extended High Performance Cartridge Tapes have a capacity of:

- E-Series:
  - 40 GB (native compression)
  - 120 GB (3:1 LZI compression)
- B-Series:
  - 20 GB (native compression)
  - 60 GB (3:1 LZI compression)

  Prior generation High Performance Cartridge Tapes provide half the capacity of the Extended High Performance Cartridge Tapes.

Magstar 3590 metal particle tape media is housed in a cartridge with the same physical size as 3480 cartridges, enabling coexistence in an IBM Magstar 3494 tape library together with current media. The Magstar 3494 tape library with Magstar 3590 drives provides access to as much as 748 TB (using Extended High Performance Cartridge Tapes with 3:1 LZI compression).

Cost Effectiveness

High capacity means that less equipment, fewer cartridges, and fewer tape mounts are required. High performance can reduce the number of drives required. This translates into less floorspace for tape cartridge storage, tape drives, and tape libraries. Maintenance costs are also lower than those for high-performance helical and 3480/3490 drives.

A reusable storage asset, the Magstar 3590 protects existing investments and can be used as the foundation for a broad array of storage solutions. Magstar 3590 tape drives leverage IBM Seascape principles, enabling flexible movement between storage solutions.

Ease of Use

The Magstar 3590 Tape Subsystem incorporates a 10-slot ACF for high-capacity unattended operation. The ACF can be used in random access mode as a mini-library. Cartridges are loaded into the ACF in a convenient, portable 10-cartridge magazine. Magstar 3590 features an operator/service display showing device status, activities, error conditions, and messages.

Service

Magstar 3590 does not require scheduled preventive maintenance. IBM customer engineers use a built-in subsystem panel to perform service functions.

3590 Models

The 3590 is available in five models for SCSI attachment:

- The 3590 Model B11 is rack-mounted and incorporates a 10-cartridge ACF for high-capacity unattended operation. The Model B11 can be modified to a Model B1A.
- The 3590 Model B1A has no ACF and is designed to be incorporated into the Magstar 3494 tape library, which provides up to 372 TB of data (compressed at 3:1) by utilizing Magstar 3590 Model B1A tape drives.
- The Magstar Model C12 with one to four Model B1A or E1A tape drives provides attachment to the StorageTek 4410 and 9310 ACS.
- The 3590 Model E11 is rack-mounted and incorporates a 10-cartridge ACF for high-capacity unattended operation. The Model B11 can be modified to a Model B1A.
- The 3590 Model E1A has no ACF and is designed to be incorporated into the Magstar 3494 tape library, which provides up to 744 TB of data (compressed at 3:1) by utilizing Magstar 3590 Model B1A tape drives.

Storage Management Software

Tivoli Storage Manager (TSM) is a client/server storage management product that provides save/restore, archive, hierarchical storage, and disaster recovery functions for networked workstations and servers. TSM uses the full capacity of the Magstar 3590 and supports the Magstar 3590's ACF in random access mode. TSM also supports the Magstar 3590 in a Magstar 3494 tape library.

Many other popular automated storage software products support the Magstar 3590 and 3494 tape systems. For a complete list of these products, call 1 800-IBM-4FAX and request item #7181.

Chapter 2. Drive SCSI Commands

This chapter describes the SCSI commands supported for the 3590 drive (LUN 0). These commands include support for the 3590 ACF when addressed as an Attached Medium Changer device at LUN 0 (this 1–LUN addressing mode is not supported on the E-Series models).

"Chapter 3. ACF SCSI Commands" on page 189 describes the SCSI commands supported for the 3590 ACF when addressed as an Independent Medium Changer device at LUN 1 (2-LUN addressing).

Note: For B-Series Models, Attached Medium Changer (1-LUN addressing) is the default operating definition for all ACF modes of operation except Random 2-LUN (see "Change Definition -X'40'" on page 10).

The following SCSI command descriptions have a table describing the fields in the Command Descriptor Block (CDB), similar to the style used in the *American National Standard of the National Committee for Information Technology Standards (NCITS)* documents:

- *SCSI—3 Media Changer Commands [t10–999D] (hereafter referred to as the "NCITS SMC document")*
- *SCSI Primary Commands [X3–301–1997] (hereafter referred to as the "NCITS SPC document")*
- *SCSI—3 Stream Commands [t10–997D] (hereafter referred to as the "NCITS SSC document")*

Any parameters or data required by each command follow these descriptions and are described in a "term-definition" format. In this format, the bits or bytes to be described are highlighted and listed on the left. The definition for the bits or bytes is to the right (not highlighted).

Bit Numbering Conventions:

Bit numbering follows ANSI standards as follows:

- Bit 0 is the least significant bit (LSB) occupying the rightmost bit position in the diagrams
- Bits 1–6 continue from right to left in ascending order
- Bit 7 is the most significant bit (MSB) occupying the leftmost bit position in the diagrams

Commands Not Supported:

Certain commands or features of some commands are not currently supported but may be in the future. All such cases are noted in the command description or in Table 1 on page 7. The following features or commands are not currently supported but may be later: Format Medium, and Volume Partitioning. The Copy, Verify, Compare, Copy/Verify, and Send commands are also not supported.

The Write Buffer command is supported but not all buffers are described in this document because most buffers are intended only to be written by the Service Representative or by Manufacturing. OEM customers who intend to support host microcode download on a new platform should contact IBM for a complete description of the Write Buffer command for this purpose. Note that new microcode

© Copyright IBM Corp. 1996, 2000

may also be loaded without requiring the use of the SCSI Write Buffer command, by using the Field Microcode Replacement (FMR tape) process described in the maintenance information manual for this product.

Drive SCSI Commands Listed Alphabetically

Table 1 provides a list of all commands defined by the referenced SCSI-3 standard or by this product as vendor-unique for sequential access devices. For each command, the operation code, reference page for this specification, applicable SCSI-3 standard section, type of support required for the command as defined by the SCSI-3 standard, and applicability of certain conditions to the command are shown.

Table 1. 3590 Drive Commands (LUN 0)

Command Name	Operation Code	See Page	SCSI Document	Applicable Conditions: RVC[1] UAT NRD WRP MFC DCC
Change Definition	X'40'	10	SPC	Y Y – – – –
Compare (Not Supported)	X'39'	NS	SPC	Y Y – – – Y
Copy (Not Supported)	X'18'	NS	SPC	Y Y – – – Y
Copy and Verify (Not Supported)	X'3A'	NS	SPC	Y Y – – – Y
Display Message	X'C0'	12	VU	Y Y – – – –
Erase	X'19'	15	SSC	Y Y Y Y Y Y
Format Medium (Not currently supported)	X'04'	NS	VU	Y Y Y Y Y[7] Y
Inquiry	X'12'	16	SPC	– – – – – –
Load Unload	X'1B'	26	SSC	Y Y Y[4] – Y[5] Y
Locate	X'2B'	28	SSC	Y Y Y – Y Y
Log Select	X'4C'	30	SPC	Y Y – – – –
Log Sense	X'4D'	32	SPC	Y – – – – –
Mode Select (6)	X'15'	74	SPC	Y Y – – – Y[8]
Mode Select (10)	X'55'	79	SPC	Y Y – – – Y[8]
Mode Sense (6)	X'1A'	83	SPC	– Y – – – –
Mode Sense (10)	X'5A'	88	SPC	– Y – – – –
Move Medium	X'A5'	126	SMC	Y Y Y – – Y[11]
Persistent Reserve In	X'5E'	127	SPC	– Y – – – –
Persistent Reserve Out	X'5F'	129	SPC	12 Y – – – –
Prevent Allow Medium Removal	X'1E'	130	SPC	Y Y – – – –
Read	X'08'	131	SSC	Y Y Y – Y Y
Read Block Limits	X'05'	133	SSC	Y Y – – – –
Read Buffer	X'3C'	134	SPC	Y – – – – –
Read Element Status	X'B8'	137	SMC	– Y Y – – Y[11]
Read Position	X'34'	138	SSC	Y Y Y – – –
Read Reverse	X'0F'	141	SSC	Y Y Y – Y Y
Receive Diagnostic Results	X'1C'	143	SPC	Y Y – – – –
Recover Buffered Data	X'14'	145	SSC	Y Y Y – – Y
Release Unit	X'17'	146	SPC	–[2] Y – – – –

Table 1. 3590 Drive Commands (LUN 0) (continued)

Command Name	Operation Code	See Page	SCSI Document	Applicable Conditions: RVC[1] UAT NRD WRP MFC DCC
Report Density Support Command	X'44'	146	SSC	Y Y - - - -
Report LUNs	X'A0'	150	SPC	- - - - - -
Request Sense	X'03'	151	SPC	- - - - - -
Reserve Unit	X'16'	158	SPC	Y[3] Y - - - -
Rewind	X'01'	159	SSC	Y Y Y - Y[5] Y
Send (Not Supported)	X'0A'	NS	SPC	- - - - - -
Send Diagnostic	X'1D'	160	SPC	Y Y Y[9] - Y[6] -
Space	X'11'	183	SSC	Y Y Y - Y Y
Test Unit Ready	X'00'	184	SPC	Y Y Y - - Y[10]
Verify (Not Supported)	X'13'	NS	SPC	Y Y Y - Y Y
Write	X'0A'	185	SSC	Y Y Y Y Y Y
Write Buffer	X'3B'	186	SPC	Y Y - - - -
Write Filemarks	X'10'	187	SSC	Y Y Y Y Y Y

Legend:

```
M  Mandatory            RVC  Reservation Conflict status
O  Optional             UAT  CHECK CONDITION status for Unit Attention
VU Vendor-Unique        NRD  CHECK CONDITION status for Not Ready
-  Not Applicable       WRP  CHECK CONDITION status for Write Protected
NS Not Supported        MFC  CHECK CONDITION status for Medium Format Corrupted
                        DCC  Deferred CHECK CONDITION
                        Y    Yes (Condition applies)
                        Yn   Yes (Condition applies per note n below)
```

Notes:

1. If an I/O process consists of linked commands and begins with a command that is not subject to the RVC condition, subsequent commands in the I/O process may be subject to Reservation Conflict status, if a linked command is subject to the RVC condition and a reservation conflict exists.
2. Performs no operation if the logical unit is reserved to another initiator.
3. Condition applies if the logical unit is reserved to another initiator.
4. CHECK CONDITION status for a not ready device is not presented to a Load Unload command that requests the load function. CHECK CONDITION status for a not ready device is presented to a Load Unload command that requests the unload function.
5. The command is not subject to the condition unless the medium format corrupted condition has not yet been reported to the initiator on some prior command.
6. This CHECK CONDITION is diagnostic dependent. Refer to the specific diagnostic in question.
7. The medium must be completely blank and degaussed with a strong degausser before it is possible to reformat it with the Format Medium command.
8. The deferred CHECK CONDITION only applies to mode page 23.
9. Currently Set SCSI ID and ACF Diagnostics return CHECK CONDITION status unless the device is NOT READY (no loaded cartridge). All others require the device to be READY.
10. Reporting of deferred CHECK CONDITION status for the Test Unit Ready command is optional based on a vendor-unique field in the CDB.
11. These commands are not supported by the Drive (LUN 0) for E-Series Models.
12. Reservation Conflict is reported as appropriate for the type of Service Action and Reservation Type requested, and the current reservation state of the drive.

Control Byte Definition

This description of the control byte fields is to be used for all of the 3590 commands.

The control byte occurs in the last byte of a command, that is, byte 5 (6-byte commands), byte 9 (10-byte commands), or byte 11 (12-byte commands). Table 2 shows the bit significance of the control byte.

Table 2. Control Byte Definition

Bit **Byte**	**7** **MSB**	**6**	**5**	**4**	**3**	**2**	**1**	**0** **LSB**
5, 9, or 11	Vendor Specific B'00'		Reserved B'0000'				Flag	Link

Note:

The Flag bit specifies which message the target returns to the initiator after transferring status if the Link bit is 1 and the command completes without an error (that is, for INTERMEDIATE status).

The Link bit is used to continue an I/O process from one command to an additional command. When the Link bit = 1, the initiator requests that the I/O process be continued and that the target enter the command phase upon successful completion of the current command. If the command completes successfully, the target reports INTERMEDIATE status and sends one of two messages as defined by the Flag bit.

The Flag and Link bits interact as follows:

- If the Link bit is 0, the Flag bit must also be zero.
- If the Link bit is 0 and the Flag bit is 1, the target returns a CHECK CONDITION status with sense key set to ILLEGAL REQUEST.
- If the Flag bit is 0 and the Link bit is 1, and if the command completes successfully, the target sends the LINKED COMMAND COMPLETE message.
- If the Flag bit is 1 and the Link bit is 1, and if the command completes successfully, the target sends the LINKED COMMAND COMPLETE (WITH FLAG) message.

Change Definition -X‘40’

The Change Definition command is supported by the 3590 drive. Table 3 shows the command format.

Table 3. Change Definition Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'40')							
1	Logical Unit Number			Reserved				
2	Reserved							Save
3	Reserved	Definition Parameter						
4	Reserved							
5	Reserved							
6	Reserved							
7	Reserved							
8	Parameter Data Length							
9	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- Save: B'0'
- Definition Parameter:

  An initiator can request one of several operating definitions to be established. If the command is accepted, the new operating definition applies to all initiators.

  After a power on condition, the drive sets its operating definition to its default value as determined by the ACF mode of operation. Any other hard reset condition does not affect the current operating definition.

  Definition Parameter description:

  X'00' Use Current Operating Definition

  X'03' SCSI-2 (including Attached Medium Changer)

  This will cause the ACF model to enable 1-LUN addressing (Attached Medium Changer) with a limited set of Medium Changer commands available through LUN 0 only. If LUN 0 receives this option and any unit or element has been reserved by another initiator, the drive returns RESERVATION CONFLICT status.

  SCSI-2 is the default operating definition for this device when the ACF is not attached or is in Manual, System, Automatic, Accumulate, or Random mode.

  Note: Definition Parameter value X'03' is allowed and ignored by E-Series models.

  X'52' Independent Medium Changer

  This will cause the ACF model to enable 2-LUN addressing (Independent Medium Changer) with Medium Changer commands available through LUN 1 only. This option is only meaningful to an ACF model operating in Random mode. The ACF mode of operation is changed to Random 2-LUN. This option is ignored on models without an ACF or when not in Random mode.

Independent Medium Changer is the default operating definition for this device when the ACF is attached and is in Random 2-LUN mode.

- Parameter Data Length: X'00'
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Display Message -X‘C0’

The Display Message command is supported by the 3590 drive. Table 4 shows the command format.

Table 4. Display Message Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'C0')							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Parameter List Length							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The Display Message command allows the initiator to use the device to display messages to the operator regarding the status and the needs of the device. Having this information at the device allows for more efficient use of the device.

The Display Message command is a vendor-unique command and, therefore, is not described in the SCSI standard. This document describes the fields in the Parameter list in general terms, such as the SCSI standard might, and follows each item with the 3590 implementation of that field.

- Parameter List Length: X'18'

  The parameter list length field specifies the length in bytes of the message display parameter list that is transferred from the initiator to the target.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

The message display parameter list follows:

Parameter List

Byte **Description**

0 Display Type

This field is not meaningful. Any value is allowed (and ignored).

1 Message Processing

The Message Processing field specifies the types of messages and how to process the messages.

Bit **Description**

7-5 Message Type

Value **Description**

0 General Status Message

Message 0, Message 1, or both are displayed according to bits 4-2, until the drive next initiates tape motion or the message is updated with a new message.

1 Demount/Verify Message

Message 0, Message 1, or both are displayed according to bits 4-2, until the current volume is unloaded. If the volume is currently unloaded, the message display is not changed and the command performs no operation.

2 Mount with Immediate Action Indicator

Message 0, Message 1, or both are displayed according to bits 4-2, until the volume is loaded. An attention indicator is activated. If the volume is currently loaded, the message display is not changed and the command performs no operation.

3-6 Reserved (invalid)

7 Demount/Mount with Immediate Action Indicator

When Message Control bits 4-2 are set to a value of 4 (B'100'), Message 0 and Message 1 are displayed alternately until the currently mounted volume, if any, is unloaded. When Message Control bits 4-2 are set to any other value, Message 0 is displayed until the currently mounted volume, if any, is unloaded. Message 1 is displayed from the time the volume is unloaded (or immediately, if the volume is already unloaded) until another volume is loaded. An attention indicator is activated.

4-2 Message Control

Value	Description
0	Display Message 0
1	Display Message 1
2	Flash Message 0
3	Flash Message 1
4	Alternate Message 0 and Message 1
5-7	Reserved (Invalid)

The life and sequences of each message must interact with the requirements of other messages, both sent or internally generated by the device.

1-0 Reserved

2-5 Reserved

6-7 Message Length

The Message Length field specifies the length of the Message field.

For the 3590 drive, the Message Length field is always X'0010'.

8-15 Message 0

Eight-character ASCII message. If both Message 0 and Message 1 consist entirely of blanks, all messages are cleared, except for ATTN, FID, and CLEAN messages.

The Message 0 field contains the data to be displayed. Characters in the message are limited to uppercase alphabetic, numeric, blank, and the following special characters:

@ $ # , . / ' ( ) * & + - = % : _ < > ? ; ¢ ¬ |

All lowercase alphabetic characters are converted to uppercase. All other characters not listed above, including nulls (X'00'), are displayed as if they had been blanks. Real blanks (X'20') must be used to force the message clearing function described above.

16-23 Message 1

Eight-character ASCII message. If both Message 0 and Message 1 consist entirely of blanks, all messages are cleared, except for ATTN, FID, and CLEAN messages.

The Message 1 field contains the data to be displayed. Characters in the message are limited to uppercase alphabetic, numeric, blank, and the following special characters:

@ $ # , . / ' ( ) * & + - = % : _ < > ? ; ¢ ¬ |

All lowercase alphabetic characters are converted to uppercase. All other characters not listed above, including nulls (X'00'), are displayed as if they had been blanks. Real blanks (X'20') must be used to force the message clearing function described above.

Erase -X‘19’

The Erase command is supported by the 3590 drive.

Table 5 shows the command format.

Table 5. Erase Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'19')							
1	Logical Unit Number			Reserved			Immed	Long
2	Reserved							
3	Reserved							
4	Reserved							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- Immed (Immediate)
  - B'0': return status when the erase operation has completed.
  - B'1': return status when the CDB has been validated.
- Long: B'1'

  All remaining medium in the current partition is erased beginning at the current logical position.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

The Erase command performs a physical medium erase from the current position to the end of the current or only partition.

Note: A tape may only be one format at a time. 3590 B-Series models erase using B-Format (density code X'29') and E-Series models erase using E-Format (density code X'2A'). At Beginning Of Tape, any tape written in one format can be changed to another format when an Erase command is issued. If an attempt is made by an E-series model to erase a B-Format tape at any other location away from Beginning of Tape, CHECK CONDITION status is returned with associated sense data of 5/3004 (Illegal Request, Cannot Write Medium — Incompatible Format). Since a B-Series model cannot read an E-Format tape, this condition cannot happen on a B-Series model.

Inquiry -X‘12’

Table 6. Inquiry Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'12')							
1	Logical Unit Number			Reserved			CmdDt	EVPD
2	Page Code							
3	Reserved							
4	Allocation Length							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

There are several forms of Inquiry data. The following are supported and described in more detail as follows:

- B-Series and E-Series Models:
  - “Inquiry Standard Data: Valid LUN (Logical Unit Number)”
  - “Inquiry Standard Data: Invalid LUN” on page 19
  - “Inquiry Page X‘00’” on page 21
  - “Inquiry Page X‘03’: ASCII Information” on page 22
  - “Inquiry Page X‘80’: Unit Serial Number” on page 23
  - “Inquiry Page X‘83’: Device Identification” on page 24
- E-Series Models **Only**:
  - “Inquiry Page X'D0'” (the contents of this page are not specified in this document)
  - “Inquiry Page X'D1'” (the contents of this page are not specified in this document)

Inquiry Standard Data: Valid LUN (Logical Unit Number)

The following 3590-specific parameters apply to this request:

- EVPD (Enable Vital Product Data): B'0'
- Page Code: X'00'
- Allocation Length: X'38' (56) bytes available
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.
- CmdDt:B'0'

For a logical unit number (LUN) that is associated with an installed device (see “SCSI-ID and LUN Assignments” on page 239), the following standard inquiry data is returned (character fields are in ASCII):

Byte Description

0

Bit Description
7-5 Peripheral Qualifier: B'000'
4-0 Peripheral Device Type: X'01' or X'08'

- If the Inquiry command is issued to LUN 0, the Sequential Access Device (tape drive) or Attached Medium Changer device LUN, then this field will be X'01'. (An Attached Medium Changer device is a limited function extension to an associated Sequential

Access device. Together, they share the same target address and LUN. The reported Peripheral Device Type is that of the Sequential Access device, but a few commands normally associated with a Medium Changer device type are supported. This is also called 1-LUN addressing.)

- If the Inquiry command is issued to a Medium Changer device that is assigned its own LUN (an Independent Medium Changer), then this field will be X'08'. (An Independent Medium Changer may have its own target/LUN address, or if it shares a target address with other logical units, then it has its own LUN within that target. The latter is also called 2-LUN addressing.)

  Note: For B-Series models, Attached Medium Changer (1-LUN addressing) is the default operating definition for all ACF modes of operation except Random 2-LUN (see “Change Definition -X‘40’” on page 10).

1

Bit	Description
7	RMB (Removable Medium Bit): B'1'
6-0	Reserved

2

Bit	Description
7-6	ISO/IEC Version: B'00'
5-3	ECMA Version: B'000'
2-0	ANSI Approved Version: B'011'

3

Bit	Description
7	AERC (Asynchronous Event Reporting Capability): B'0'
6	Obsolete: B'0'
5	NormACA (Normal ACA Supported): B'0'
4	HiSupport (Hierarchical Support): B'0'
3-0	Response Data Format: B'0010'

4 Additional Length (n-4): X'33'

5

Bit	Description
7	SCCS (An SCC Supported): B'0'
6-0	Reserved

6 This byte supports SCSI-3 changes. In SCSI-2, this byte was reserved.

Bit	Description
7	BQue (Basic Queueing): B'0'
6	EncServ (Enclosure Service): B'0'
5	BarC: B'0'
4	MultiP (Multi-Port): B'0'
3	Mchngr (Medium Changer):

For E-Series models, this field is always set to B'0'.

For B-Series models, the value of this field depends on the mode of the ACF. If the ACF is in Random mode, this field is set to B'1'. If the ACF mode is Manual, System, Automatic, Accumulate, Random 2-LUN, or no automation, this field is set to B'0'. (This bit may

change because the Change Definition command is sent or the operator selects a different mode.) If this bit changes, an unit attention condition is created for all initiators with associated sense data of 6/3F03 (Unit Attention, Inquiry Data Changed). See “Mode Page X‘20’: ACF (Loader) Control” on page 110 for the current library mode.

2 AckReqQ: B'0'
1 Addr32: B'0'
0 Addr16: B'1'

7

Bit	Description
7	RelAdr (Relative Addressing): B'0'
6	WBus32 (Wide Bus 32): B'0'
5	WBus16 (Wide Bus 16): B'1' (2-byte wide attachment only)
4	Sync (Synchronous Transfer): B'1'
3	Linked: B'1'
2	TranDis (Transfer Disable): B'0'
1	CmdQue (Command Queuing): B'0'
0	SftRe (Soft Reset): B'0'

8-15 Manufacturer: ‘IBM ’ (in ASCII)

16-31 Device Type and Model Number: ‘03590xxx ’ (in ASCII)

The device type is ‘03590’ and the model number is ‘xxx’; ‘xxx’ can be ‘B1A’, or ‘B11’, or ‘E1A’, or ‘E11’.

32-35 Product Revision Level (3590 Microcode Revision Level in ASCII)

36-37 IBM Plant of Manufacture Code.

38-49 Serial Number of device, right justified with leading zeroes, in ASCII.

50-51 For Port 0: ‘ 0’ (in ASCII); For Port 1: ‘ 1’ (in ASCII)

52 Equipment Flags

Bit	Description
7-5	Reserved
4	Auto-Share Feature Installed (see “Multiple Port Behavior” on page 239) • B'0': Indicates Auto-Share feature is not installed • B'1': Indicates Auto-Share feature is installed
3	Independent Medium Changer Installed (see byte 0, bits 4-0) • B'0': Indicates a Medium Changer is not addressable at this SCSI ID. • B'1': Indicates a Medium Changer is addressable at LUN 1 of this SCSI ID.
2	Library Attached • B'0': the device is not attached to a library facility (3494 or 3495) • B'1': the device is attached to a library facility (3494 or 3495)
1	ACF Attached • B'0': the device does not have an ACF attached. • B'1': the device has an ACF attached
0	Message Display: B'1' The device is equipped with a message display.

53 SCSI Customization byte: X'00'

54 Reserved

55 Message Display Type : X'81'

Inquiry Standard Data: Invalid LUN

The following 3590-specific parameters apply to this request:

- EVPD (Enable Vital Product Data): B'0'
- Page Code: X'00'
- Allocation Length: The maximum number of bytes to be transferred. For E-Series Models, there are two densities supported by the device. The number of bytes returned will be 108 bytes. For B-Series Models, there is one density supported by the device. The number of bytes returned will be 56 bytes.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

For a LUN that is not associated with an installed device (see “SCSI-ID and LUN Assignments” on page 239), the following standard inquiry data is returned (character fields are in ASCII):

Byte **Description**

0

Bit	Description
7-5	Peripheral Qualifier: B'011'
4-0	Peripheral Device Type: X'1F'

1

Bit	Description
7	RMB (Removable Medium Bit): B'0'
6-0	Reserved

2

Bit	Description
7-6	ISO/IEC Version: B'00'
5-3	ECMA Version: B'000'
2-0	ANSI Approved Version: B'011'

3

Bit	Description
7	AERC (Asynchronous Event Reporting Capability): B'0'
6	Obsolete: B'0'
5	NormACA (Normal ACA Supported): B'0'
4	HiSupport (Hierarchical Support): B'0'
3-0	Response Data Format: B'0010'

4 Additional Length (n-4): X'1F' (31 bytes)

5

Bit	Description
7	SCCS (An SCC Supported): B'0'
6-0	Reserved

7

Bit	Description
7	RelAdr (Relative Addressing): B'0'
6	WBus32 (Wide Bus 32): B'0'
5	WBus16 (Wide Bus 16): B'1' (2-byte wide attachment only)
4	Sync (Synchronous transfer): B'1'
3	Linked: B'1'

2 TranDis (Transfer Disable): B'0'
1 ComQue (Command Queuing): B'0'
0 SftRe (Soft Reset): B'0'

8-15 Manufacturer: ‘IBM ’ (in ASCII code)

16-31 Device Type and Model Number: ASCII blanks are returned

32-35 Product Revision Level: ASCII blanks are returned

Inquiry Page X‘00’

The following 3590-specific parameters apply to this request:

- EVPD (Enable Vital Product Data): B'1'
- Page Code: X'00'
- Allocation Length:
  - For B-Series Model: X'08' bytes available
  - For E-Series Model: X'0A' bytes available
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

For a LUN that is associated with an installed device (see “SCSI-ID and LUN Assignments” on page 239), the following data is returned:

Byte **Description**

0 Peripheral Data

Bit	**Description**
7-5	Peripheral Qualifier: B'000'
4-0	Peripheral Device Type: X'01' or X'08'

1 Page Code: X'00'

2 Reserved

3 Page Length (n-3):

- B-Series Models: X'04'
- E-Series Models: X'06'

4 Supported Page: X'00'

5 Supported Page: X'03'

6 Supported Page: X'80'

7 Supported Page: X'83'

Note: The following data is associated with E-Series Models **only**

8 Supported Page: X'D0'

9 Supported Page: X'D1'

Inquiry Page X‘03’: ASCII Information

The following 3590-specific parameters apply to this request:

- EVPD (Enable Vital Product Data): B'1'
- Page Code: X'03'
- Allocation Length: X'25' (37) bytes available
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

For a LUN that is associated with an installed device (see “SCSI-ID and LUN Assignments” on page 239), the following data is returned:

Byte **Description**

0

Bit	Description
7-5	Peripheral Qualifier: B'000'
4-0	Peripheral Device Type: X'01' or X'08'

1 Page Code: X'03'

2 Reserved

3 Page Length: X'21'

4 ASCII Length: X'00'

5-7 Reserved

8-11 Load ID

The Load ID of ROM microcode, represented by eight hex characters, is used to determine if the microcode to be downloaded is compatible with the device electronics.

12-15 Rev Level

The Revision Level of the device microcode, represented with four ASCII characters, is used to determine if the latest level of microcode is downloaded. As each change is implemented, the Rev Level chosen must be numerically larger than any previous Rev Level used, as determined by converting the ASCII characters to numerical format and subtracting. For example, if the old Rev Level is ASCII 2M3P, and the new Rev Level is ASCII 2M3Q, that is equivalent to X'50775180' and X'50775181', respectively. When the two values are compared numerically, the new Rev Level is one greater than the old Rev Level, which satisfies the requirement.

16-19 PTF Number: Not used. This field is Reserved.

21-23 Patch Number: Not Used. This field is Reserved.

24-31 RU Name

Used by the attaching system. This is an 8-byte EBCDIC field that is incremented each time the Load ID is incremented.

32-36 Library Sequence Number (in ASCII). This field applies to the IBM 3494 Library only. This field matches the information returned in RS/422 initialization response, bytes 38-42.

Inquiry Page X‘80’: Unit Serial Number

The following 3590-specific parameters apply to this request:

- EVPD (Enable Vital Product Data): B'1'
- Page Code: X'80'
- Allocation Length: X'10' (16) bytes available

For a LUN that is associated with an installed device (see “SCSI-ID and LUN Assignments” on page 239), the following data is returned:

Byte	Description
0	Peripheral Data

Bit	Description
7-5	Peripheral Qualifier: B'000'
4-0	Peripheral Device Type: X'01' or X'08'

1	Page Code: X'80'
2	Reserved
3	Page Length: X'0C'
4-15	Serial Number of device, right-justified with leading zeroes, in ASCII (same as Inquiry Standard Data bytes 38-49)

Inquiry Page X‘83’: Device Identification

The following 3590-specific parameters apply to this request:

- EVPD (Enable Vital Product Data): B'1'
- Page Code: X'83'
- Allocation Length: X'2C' (44) bytes available

For a LUN that is associated with an installed device (see “SCSI-ID and LUN Assignments” on page 239), the following data is returned:

Byte	Description
0	Peripheral Data **Bit** **Description** **7-5** Peripheral Qualifier: B'000' **4-0** Peripheral Device Type: X'01'
1	Page Code: X'83'
2	Reserved
3	Page Length: X'28'
4	**Bit** **Description** **7-4** Reserved **3-0** Code Set: X'2' (Identifier is all ASCII)
5	**Bit** **Description** **7-6** Reserved **5-4** Association: B'00' **3-0** Identifier Type: X'1'
6	Reserved
7	Identifier Length: X'24'
8-15	Vendor ID (same as Inquiry Standard Data bytes 8-15)
16-31	Device Type and Model Number (same as Inquiry Standard Data bytes 16-31)
32-43	Serial Number of device (same as Inquiry Standard Data bytes 38-49)

Bytes 44-55 are returned only on Fibre Channel attached devices

44	**Bit** **Description** **7-4** Reserved **3-0** Code Set: X'1'
45	**Bit** **Description** **7-6** Reserved **5-4** Association Type: B'00' **3-0** Identifier Type: X'3'
46	Reserved
47	Identifier Length: X'3'

48

Bit	Description
7-4	Name Format B'0101'
3-0	OUI Format Identifier

49-50 OUI Format Identifier (continued)

51

Bit	Description
7-4	OUI Format Identifier (continued)
3-0	Vendor Specific Identifier

52 Vendor Specific Identifier (continued)

53

Bit	Description
7-6	Port/Node ID: 0
5-0	Serial Number

54-55 Serial Number (continued)

Load Unload -X‘1B’

The Load Unload command is supported by the 3590 drive. Table 7 shows the command format.

Table 7. Load Unload Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1B')							
1	Logical Unit Number		Reserved					Immed
2	Reserved							
3	Reserved							
4	Reserved					EOT	Re-Ten	Load
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- Immed (Immediate)
  - B'0': Indicates the drive is to present status when the command is completed.
  - B'1': Indicates the drive is to present status as soon as all buffered commands have completed execution and the CDB of the Load Unload command has been validated. With the exception of Inquiry, Request Sense, and Test Unit Ready, subsequent commands are queued until the load/unload operation is complete. The completion status of the load/unload operation may be polled by sending a Request Sense command until the sense data returned is no longer 2/0407 (Not Ready, Logical Unit Not Ready, Operation in Progress).
- EOT (End of Tape): B'0'
- Re-Ten (Retention): B'0'
- Load:
  - B'0': In all models, causes an eject of the cartridge from the drive. If this command is received and there is no cartridge present in the drive, the command is presented with CHECK CONDITION status and associated sense data of 2/3A00 (Not Ready, Medium Not Present).

    Note: The Load Unload command with the Load bit set to B'0' is sometimes called an ‘unload command’. The subsequent action of the ACF in response to the unload event is ACF mode-dependent:

    - For Manual, Accumulate, Automatic, and System modes, the ACF automatically, without further initiator commands, takes the ejected cartridge from the device and places it in the appropriate cell of the ACF.
    - For Random and Random 2-LUN modes, the ACF does not respond automatically, but moves the cartridge to its destination only when ordered by a Move Medium command from an initiator.
  - B'1': supported by the 3590 drive only if an ACF is present and the ACF is in System mode, or if no ACF is present and a cartridge was unloaded, but not removed from the drive. In this case, the command performs a reload function that may be useful during certain error recovery processes. If this command is received and Load set to B'1' is not supported, the command is presented with CHECK CONDITION status and associated sense data of 2/3A00 (Not Ready, Medium Not Present). If this command is received and Load set to B'1' is supported but there is already a cartridge present in the device, the

command is presented with CHECK CONDITION status and associated sense data of 2/0403 (Not Ready, Logical Unit Not Ready - Manual Intervention Required).

- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Locate -X‘2B’

Table 8 shows the command format.

Table 8. Locate Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'2B')							
1	Logical Unit Number			Reserved		BT	CP	Immed
2	Reserved							
3	Block Address							
4								
5								
6								
7	Reserved							
8	Partition							
9	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- BT (Block address Type): B'0'.
- CP (Change Partition):

  Note: Partitioning of a volume is not currently supported, but may be in the future.
  - B'0': no partition change is to be made; locate to the specified block address within the current partition. The Partition field is to be ignored.
  - B'1': change to the partition specified by the Partition field prior to locating to the specified Block Address within the partition.
- Immed (Immediate):
  - B'0': present status when command is completed.
  - B'1': present status when all buffered commands have completed execution and the CDB of the Locate command is validated.
- Block Address:

  The destination of the locate operation. This field is a value from X'0000 0000' to X'FFFF FFFF'.
- Partition:

  Note: Partitioning of a volume is not currently supported, but may be in the future.

  The partition field specifies the partition to select, when the CP field is B'1'.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

If the drive encounters End-of-Data (EOD) while executing this command, the command is terminated at the EOD position and CHECK CONDITION status is returned with associated sense data of 8/0005 (Blank Check, End-of-Data Detected). If the next motion command is another request to move forward (beyond EOD), the drive accepts the command and attempts to position beyond EOD in order to allow recovery of old data

B-Series Models cannot read or locate on an E-Format tape. If such an attempt is made, CHECK CONDITION status is returned and Associated sense data is set to 3/3002 (Medium Error, Cannot Read Medium — Incompatible Format).

Log Select -X‘4C’

Table 9. Log Select Command

Bit / Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'4C')							
1	Logical Unit Number			Reserved			PCR	SP
2	PC		Reserved					
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Parameter List Length							
8								
9	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- PCR (Parameter Code Reset):
  - B'0': Indicates that the log parameters will not be reset.
  - B'1': If the parameter list length is zero, all cumulative and threshold log counter values will be reset to their default values except Page X'3D' (ACF Statistics). If the parameter list length is not zero, the command is terminated with CHECK CONDITION status and associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).
- SP (Save Parameters): B'0' (Saving of the Log Select parameters is not supported)
- PC (Page Control):
  - B'00' (Threshold Values): Supported for all log pages with log counters (LP field set to B'0' in the Log Parameter Control Byte) except for Page X'3D' (ACF Statistics).

    Threshold Notes:

    1. The 3590 drive treats each threshold value as a maximum value for the log counter field. Generally, when a threshold/maximum is reached, all log counters in that specific log page are locked (no longer updated) until a subsequent reset via a Log Select command.
    2. Only the overflowed log counter is locked for Page X'38' (Blocks/Bytes Transferred) - all other log counters continue incrementing for this log page.
    3. Log counters for Page X'3D' (ACF Statistics) will lock at maximum values and cannot be reset.
    4. If the RLEC bit is set to B'1' in Mode Page X'0A' (Control Mode) and a log counter reaches its threshold/maximum, the drive will report a deferred CHECK CONDITION status with associated sense data of 1/5B02 (Recovered Error, Log Counter at Maximum) on the next command eligible for a deferred check condition (see Table 1 on page 7). The drive does not report error sense associated with the threshold condition being met.
  - B'01' (Cumulative Values): Supported for all log pages with log counters (LP field set to B'0' in the Log Parameter Control Byte) except for Page X'3D'.

  - B'10' (Default Threshold Values): Not supported. The default threshold value for all two-byte log counter fields is X'FFFF'. The default threshold value for all four-byte log counter fields is X'FFFF FFFF'.
  - B'11' (Default Cumulative Values): Not supported. The default cumulative value for all two-byte log counter fields is X'0000'. The default cumulative value for all four-byte log counter fields is X'0000 0000'.

  If the PCR field is set to B'1', the PC field is ignored.
- Parameter List Length:

  This field specifies the length in bytes of the parameter list that is to be transferred to the drive. A parameter list length of zero indicates that no pages are to be transferred. If the parameter list length is zero and the PC field is set to B'00' (Current Threshold Values), the current threshold parameters are set to the default threshold values. If the parameter list length is zero and the PC field is set to B'01' (Current Cumulative Values), the current cumulative parameters are set to the default cumulative values (zero).

  Note: If the PCR field is set to B'1', this field must be set to zero.

  If the parameter list length results in the truncation of any log parameter, the command is terminated with CHECK CONDITION status and associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Only one log page is accepted for each Log Select command. For each log page, any combination of the supported log parameters may be sent. If multiple log parameters are sent, they must be sent in ascending order by parameter code value. Only the Parameter Value field may be changed from the log parameters that are returned from Log Sense (see “Log Parameter Format” on page 33). Changes to the Log Parameter Control Byte are not supported.

Note: Initiators should issue a Log Sense command prior to issuing a Log Select command to determine supported log parameter fields.

If a parameter list is received with an unsupported log page, a log parameter code out of order, or a change to a log parameter field other than the Parameter Value, the command is terminated with CHECK CONDITION status and associated sense data of 5/2600 (Illegal Request, Invalid Field in Parameter List).

The following log pages are supported for the Log Select command:

- “Log Page X‘02’: Write Error Counters” on page 36
- “Log Page X‘03’: Read Error Counters” on page 38
- “Log Page X‘06’: Non-Medium Errors” on page 40
- “Log Page X‘0C’: Sequential-access device” on page 41
- “Log Page X‘32’: Write Errors” on page 47
- “Log Page X‘34’: Read Forward Errors” on page 51
- “Log Page X‘36’: Read Reverse Errors” on page 58
- “Log Page X‘38’: Blocks/Bytes Transferred” on page 59
- “Log Page X‘39’: SCSI Port 0 Interface Errors” on page 63
- “Log Page X‘3A’: SCSI Port 1 Interface Errors” on page 65
- “Log Page X‘3B’: Equipment Check Errors” on page 66

Log Sense -X‘4D’

The Log Sense command is supported by the 3590 drive. Table 10 shows the command format.

Table 10. Log Sense Command

Bit / Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'4D')							
1	Logical Unit Number			Reserved			PPC	SP
2	PC		Page Code					
3	Reserved							
4	Reserved							
5	Parameter Pointer							
6								
7	Allocation Length							
8								
9	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The Log Sense command supports the following page codes: X'00', X'02', X'03', X'06', X'0C', X'31', X'32', X'34', X'36', X'38', X'39', X'3A', X'3B', and X'3D'. Page code X'00' lists all page codes supported by the 3590 drive. Page codes X'00', X'02', X'03', and X'06' are defined by the referenced SCSI-2 standard. All other page codes are vendor-unique pages.

The following 3590-specific parameters apply:

- PPC (Parameter Pointer Control): B'0'
- SP (Save Parameters): B'0'
- PC (Page Control):
  - B'00' (Threshold Values): Supported for all log pages with log counters (LP field set to B'0' in the Log Parameter Control Byte). For additional information, see “Threshold Notes” on page 30.
  - B'01' (Cumulative Values): Supported for all log pages.
  - B'10' (Default Threshold Values): Supported for all log pages with log counters. The default threshold value for all two-byte log counter fields is X'FFFF'. The default threshold value for all four-byte log counter fields is X'FFFF FFFF'.
  - B'11' (Default Cumulative Values): Not supported. The default cumulative value for all two-byte log counter fields is X'0000'. The default cumulative value for all four-byte log counter fields is X'0000 0000'.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Unless otherwise specified, each log counter is reset when read by the Log Sense command. Specific exceptions include Page X'3D'(Subsystem Statistics). Several pages have values which are reset at load time, as specified.

Log Page Format

Each log page begins with a 4-byte header, followed by zero or more variable-length log parameters defined for that page. Table 11 on page 33 shows the log page format.

Table 11. Log Page Format

Bit / Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Reserved		Page Code (identifies the Log Page being transferred)					
1	Reserved							
2	Page Length (n-3)							
3								
	Log Parameters (See “Log Parameter Format”)							
4	Log Parameter (first)							
x+3	(Length = x)							
	.							
	.							
n-y+3	Log Parameter (last)							
n	(Length = y)							

Log Parameter Format

Each log parameter begins with a 4-byte parameter header, followed by one or more bytes of parameter data. Table 12 shows the log parameter format. The fields of byte 2 are described under “Log Parameter Byte 2–Control Byte”.

Table 12. Log Parameter Format

Bit / Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Parameter Code							
1								
2	DU	DS	TSD	ETC	TMC		Reserved	LP
3	Parameter Length (n-3)							
4	Parameter value							
n								

Log Parameter Byte 2–Control Byte

A Log Parameter Control Byte is returned for each parameter code described in the log pages. The Log Parameter Control Byte is described here one time only. Any parameters using a different Log Parameter Control Byte have that byte described within that parameter.

Note: The contents of this byte are fixed by the 3590 drive; the user cannot set these values. This byte is part of the returned data described in section 8.3.2 (Log Parameters) in the referenced SCSI-2 standard; it is described in the following list:

Bit	Description
7	DU (Disable Update): B'0'
6	DS (Disable Save): B'1'
5	TSD (Target Save Disable): B'1'
4	ETC (Enable Threshold Comparison): B'0'
3-2	TMC (Threshold Met Comparison): B'00'
1	Reserved

0	LP (List Parameter): B'0' (indicates this is a log counter)

Log Page X‘00’: Supported Log Pages

This log page returns the list of log pages supported by the 3590 drive. This page does not contain any log parameters.

Byte	Description
0	

Bit	Description
7-6	Reserved
5-0	Page Code (B'000000')

1	Reserved
2-3	Page Length (X'000E')
4	Supported Log Pages (X'00')
5	Write Error Counters page (X'02')
6	Read Error Counters page (X'03')
7	Non-Medium Errors page (X'06')
8	Sequential-access device (X'0C')
9	SIM/MIM page (X'31')
10	Write Errors page (X'32')
11	Read Forward Errors page (X'34')
12	Read Reverse Errors page (X'36')
13	Blocks/Bytes Transferred page (X'38')
14	SCSI Port 0 Interface Errors page (X'39')
15	SCSI Port 1 Interface Errors page (X'3A')
16	Equipment Check Errors page (X'3B')
17	Subsystem Statistics page (X'3D')

Log Page X‘02’: Write Error Counters

This page is one of the defined error counter pages in the referenced SCSI-2 standard. This page is for Write Errors. It is reset when the cartridge is loaded.

Byte **Description**

0

Bit	Description
7-6	Reserved
5-0	Page Code: X'02'

1 Reserved

2-3 Page length: The page length is determined by the parameters and the number of parameters selected for transmission to the initiator.

The following parameter codes are supported for the Write Error Counter page (page code X'02'):

X'0002'

Total Write Errors

The sum of the total corrected Write Errors and total Uncorrected Write Errors.

Byte	Description
0-1	Parameter Code: X'0002'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Total Write error count (2-byte binary format)

X'0003'

Total Corrected Write Errors

The total of the Corrected Write errors. These errors are corrected by ECC “on the fly” and do not require error recovery procedures (ERPs). Each count represents one block in error that was corrected and written.

Byte	Description
0-1	Parameter Code: X'0003'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Corrected write error count (2-byte binary format)

X'0005'

Total Write Kilobytes Processed

Each count represents a kilobyte (1024 bytes) of data processed across the SCSI interface during write-type commands. The count does not include ERP retries. This field is identical to the SCSI Write Kilobytes Processed field of Page Code X'38', parameter code X'0001'.

Byte	Description
0-1	Parameter Code: X'0005'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Total kilobytes processed count (4-byte binary format)

Refer to “Scaled Log Page Counters” on page 239 for a description of this scaled counter.

X'0006'

Total Uncorrected Write Errors

The total number of write errors that could not be corrected by ECC “on the fly,” no servo error was reported, and the error was not a transient error. Each count represents one block in error that was not corrected “on the fly” but was recovered by ERPs and successfully written.

Byte	Description
0-1	Parameter Code: X'0006'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Uncorrected write error count (2-byte binary format)

Log Page X‘03’: Read Error Counters

This page is one of the defined error counter pages. This page is for Read Errors. It is reset when a cartridge is loaded.

Byte	Description
0	

Bit	Description
7-6	Reserved
5-0	Page Code: X'03'

1	Reserved
2-3	Page length: The page length is determined by the parameters and by the number of parameters selected for transmission to the initiator.

The following parameters are supported for the Read Error Counter page (page code X'03'):

X'0002'

Total Read Errors

The sum of the total corrected Read Errors and the total Uncorrected Read Errors.

Byte	Description
0-1	Parameter Code: X'0002'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Total Read error count (2-byte binary format)

X'0003'

Total Corrected Read Errors

The total of the Corrected Read errors. These are errors that are corrected by ECC “on the fly” and do not require error recovery procedures (ERPs). Each count represents one block in error that was corrected and read.

Byte	Description
0-1	Parameter Code: X'0003'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Corrected read error count (2-byte binary format)

X'0005'

Total Read Kilobytes Processed

Each count represents a kilobyte (1024 bytes) processed across the SCSI interface during read-type commands. The count does not include ERP retries. This field is identical to the SCSI Read Kilobytes Processed field of Page Code X'38', parameter code X'0003'.

Byte	Description
0-1	Parameter Code: X'0005'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Total kilobytes processed count (4-byte binary format)

Refer to “Scaled Log Page Counters” on page 239 for a description of this scaled counter.

X'0006'

Total Uncorrected Read Errors

The total number of read errors that could not be corrected by ECC “on the fly,” no servo error was reported, and the error was not a transient error. Each count represents one block in error that was not corrected “on the fly,” but was recovered by ERPs and successfully read.

Byte	Description
0-1	Parameter Code: X'0006'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Uncorrected read error count (2-byte binary format)

Log Page X‘06’: Non-Medium Errors

This page permits you to sum the occurrences of error events other than write or read failures. Parameter codes do not discriminate among the various types of events. This page is reset when a cartridge is loaded.

Byte	Description

0

Bit	Description
7-6	Reserved
5-0	Page Code: X'06'

1 Reserved

2-3 Page length:

The page length is determined by the parameters and the number of parameters selected for transmission to the initiator.

The following parameters are supported for the Non-Medium Error Counter page (page code X'06'):

X'0000'

Non-Medium Error Count

Byte	Description
0-1	Parameter Code: X'0000'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Non-medium error count (4-byte binary format)

Log Page X‘0C’: Sequential-access device

This page is one of the defined pages in the referenced SSC standard. This page is for counters specific to tape drives.

Byte	Description

0

Bit	Description
7-6	Reserved
5-0	Page Code: X'0C'

1 Reserved

2-3 Page length:

The following parameters are supported for the Sequential Access Device (page code X'0C'):

X'0000'

Total Channel Write Bytes

The total number of bytes written between the host and the tape device on this mount.

Byte	Description
0-1	Parameter Code: X'0000'
2	Parameter control byte (see Page 33)
3	Parameter length: X'06'
4-9	Total Channel Write Bytes

X'0001'

Total Device Write Bytes

The total number of bytes written to tape on this mount.

Byte	Description
0-1	Parameter Code: X'0001'
2	Parameter control byte (see Page 33)
3	Parameter length: X'06'
4-9	Total Device Write Bytes

X'0002'

Total Device Read Bytes

The total number of bytes read from tape on this mount.

Byte	Description
0-1	Parameter Code: X'0002'
2	Parameter control byte (see Page 33)
3	Parameter length: X'06'
4-9	Total Device Read Bytes

X'0003'

Total Channel Read Bytes

The total number of bytes read by the host on this mount.

Byte	Description
0-1	Parameter Code: X'0003'
2	Parameter control byte (see Page 33)
3	Parameter length: X'06'

4-9	Total Channel Read Bytes

X'0100'

Cleaning Required

A non-zero value indicates cleaning required.

Byte	Description
0-1	Parameter Code: X'0100'
2	Parameter control byte (see Page 33)
3	Parameter length: X'01'
4-9	Cleaning Required

Log Page X‘31’: SIM/MIM

Page Code 31 is designed to support SIMs (Service Information Messages), and MIMs (Medium Information Messages). SIMs and MIMs provide the initiator and operator details on service problems encountered by the device.

This page is **not** reset when a cartridge is loaded. When read with a Log Sense command, only the returned SIM or MIM is no longer available for subsequent retrieval. SIMs and MIMs are stored in and retrieved from a first-in first-out (FIFO) queue. Only 1 SIM or MIM is returned for each Log Sense command that requests Page Code X'31'. The first 9 bytes are common to both the SIMs and the MIMs.

SIM/MIM Header Data

Byte	Description
0	Page Code

Bit	Description
7-6	Reserved
5-0	Page Code: X'31'

1	Reserved
2-3	Page Length: X'0044'
4-5	Parameter Code: X'0000'
6	Parameter control byte

Bit	Description
7	DU (Disable Update): B'0'
6	DS (Disable Save): B'1'
5	TSD (Target Save Disable): B'1'
4	ETC (Enable Threshold Comparison): B'0'
3-2	TMC (Threshold Met Comparison): B'00'
1	Reserved
0	LP (List Parameter): B'1'

7	Parameter length: X'40'
8	SIM/MIM Indicator

Value	Description
X'00'	Bytes 9 through 71 are invalid.
X'01'	Bytes 9 through 71 are a SIM message. See “SIM Messages”.
X'02'	Bytes 9 through 71 are a MIM message. See “MIM Messages” on page 45.
X'03-FF'	Bytes 9 through 71 are invalid.

SIM Messages

The following data are the parameters for the hardware SIM message:

Byte	Description
9-15	Reserved
16-19	Engineering Data
20-21	SIM Message Code

Value (ASCII)	Description
‘00’	No Message
‘41’	Device Degraded. Call for Service

'42'	Device Hardware Failure. Call for Service
'43'	Service Circuits Failed, Operations Not Affected. Call for Service
'55'	Drive Needs Cleaning. Load Cleaning Cartridge
'57'	Drive Has Been Cleaned
All Others	Device Message

22-23 Reserved

24 Exception Message Code

Value (ASCII)	Description
'0'	Reserved
'1'	Effect of Failure Is Unknown
'2'	Device Exception. No Performance Impact
'3'	Exception on SCSI Interface xx See bytes 28-29 (Exception Data xx) in this SIM record for the xx value.
'4'	Device Exception on ACF
'5'	Device Exception on Operator Panel
'6'	Device Exception on Tape Path
'7'	Device Exception in Drive
'8'	Cleaning Required
'9'	Cleaning Done
'A-F'	Reserved

25 Service Message Code

Value (ASCII)	Description
'0'	Reserved
'1'	Repair Impact is Unknown
'2-6'	Reserved
'7'	Repair Will Disable Access to Device serno (serno refers to serial number in bytes 52-63 of this SIM record)
'8'	Repair Will Disable Message Display IDs on Device
'9'	Clean Device
'A'	Device Cleaned
'B'	Device Cleaning For Performance Reasons is Required
'C-F'	Reserved

26 Service Message Severity Code

Value (ASCII)	Description
'0'	SIM severity code “Service”
'1'	SIM severity code “Moderate”
'2'	SIM severity code “Serious”
'3'	SIM severity code “Acute”
'4-9, A-F'	Reserved

27 Reserved

28-29 Exception Data xx

The Interface data is used when byte 24 (Exception Message Code) in this SIM record contains the ASCII value '3'.

- If xx = '00', interface 0 is indicated;
- if xx = '01', interface 1 is indicated.

30-33 FRU Identifier

34-37 First FSC

38-41 Last FSC

42-45 Product ID: ‘8000’ (these four bytes define “TAPE”)

46-63 Product Identifier

Value (ASCII)	Description
46-48	Manufacturer: “IBM”
49-50	Plant of Manufacture
51	‘ - ’ (Dash symbol)
52-63	Serial Number

64-71 Device Type and Model Number (same as Inquiry Standard Data bytes 16-23)

MIM Messages

Media Information Messages (MIMs) are supported for 3590 drives. The following data are the parameters for the MIM:

Byte	Description
9-15	Reserved
16-19	Expert Systems Data (microcode link level)
20-21	MIM Message Code

Value (ASCII)	Description
‘00’	No Message
‘60’	Bad Media, Read Only permitted
‘61’	Rewrite Media if possible
‘62’	DBM Invalid. Re-read media if possible
‘64’	Bad Media-Cannot Read or Write
‘72’	Replace Cleaner Cartridge
Others	Reserved

22-23 Engineering Data-First Failing Test

24 Exception Message Code

Value (ASCII)	Description
‘2’	Data Degraded
‘4’	Medium Degraded
‘6’	Block 0 Error
‘7’	Medium Exception
Others	Reserved

25 Reserved

26 Media Message Modifier Severity Code

Value (ASCII)	Description
‘0’	“Service”
‘1’	“Moderate”-High Temp Read/Write Errors Detected
‘2’	“Serious”-Permanent Read/Write Errors Detected
‘3’	“Acute”-Block 0 Error
Others	Reserved

27-29 Reserved

30-33 Fault Symptom Code (FSC)

34-39 VOLID (in ASCII). Only valid if indicated by VOLID Valid Flag (byte 40)

40 VOLID Valid Flag

Value (ASCII)	Description
'0'	VOLID (bytes 34-39) not valid
'1'	VOLID valid, obtained from tape
'3'	VOLID valid, obtained from cartridge label
'5'	VOLID valid, obtained from cartridge label
Others	Reserved for future use (odd number will always indicate VOLID valid)

41 Reserved

42-45 Product ID: '8000' (these four bytes define "TAPE")

46-63 Product Identifier

Value (ASCII)	Description
46-48	Manufacturer: "IBM"
49-50	Plant of Manufacture
51	' - ' (Dash symbol)
52-63	Serial Number

64-71 Device Type and Model Number (same as Inquiry Standard Data bytes 16-23)

Log Page X‘32’: Write Errors

Page code 32 contains detailed counters related to write operations. This page is reset when a cartridge is loaded.

Byte	Description

0

Bit	Description
7-6	Reserved
5-0	Page Code: X'32'

1 Reserved

2-3 Page length:

The page length is determined by the parameters and the number of parameters selected for transmission to the initiator.

The following parameters are supported for the Write Error page (page code X'32'):

X'0000'

Blocks Corrected

ECC is done “on the fly” by hardware. Each count represents one block in error that was successfully corrected and written. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0000'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Blocks corrected count (2-byte binary format)

X'0001'

Servo Transient Condition

ERP action was required because of a servo detected error and the first retry was successfully in place. Each count represents one block in error that was successfully recovered and written. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0001'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Servo transient condition count (2-byte binary format)

X'0002'

RDF/ECC Transient Conditions

ERP action was required because of a RDF (Read Data Flow) or ECC detected error and the first retry was successfully in place. Each count represents one block in error that was successfully recovered and written. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0002'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	RDF/ECC transient condition count (2-byte binary format)

X'0003'

Write Velocity Errors

The count of detected write velocity errors. Each count represents one occurrence, not just the count of affected blocks. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0003'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Write Velocity Error Count (2-byte binary format)

X'0004'

Servo Data Acquisition Errors

A servo error (servo dropout or off-track shutdown) was detected while trying to acquire an IBG or block at the beginning of a write append sequence; ERP action was required, and servo transient condition criteria were not met. Each count represents one block in error that was successfully recovered and written. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0004'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Servo data acquisition error count (2-byte binary format)

X'0005'

RDF Data Acquisition Errors

During read-back check, the Read Data Flow (RDF) failed to acquire an IBG or block at the beginning of a write append sequence and no servo error was reported, ERP action was required, and RDF/ECC transient condition criteria were not met. Each count represents one block in error that was successfully recovered and written. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0005'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	RDF data acquisition error count (2-byte binary format)

X'0006'

Servo Data Errors

A servo error (servo dropout or off-track shutdown) was detected while writing data, ERP action was required, and servo transient condition criteria were not met. Each count represents one block in error that was successfully recovered and written. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0006'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Servo data error count (2-byte binary format)

X'0007'

ECC Data Errors

An uncorrectable error, CRC error, instantaneous speed variation (ISV) error, or no ending burst error occurred during read back check of a block, and no servo error was reported; ERP action was required, and RDF/ECC transient condition criteria were not met. Each count represents one block in error that was successfully recovered and written. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0007'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ECC data error count (2-byte binary format)

The following counts are included in the write errors page as potentially useful information.

X'0008'

Total Write Retries

The count of the total number of ERP actions. Each count represents one occurrence, not just one time per block. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0008'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Total Write Retries (2-byte binary format)

X'0009'

Unused counter

Byte	Description
0-1	Parameter Code: X'0009'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Unused counter

X'000A'

Bellcord Actions

The count of write ERP actions based on error profiles. Each count represents one occurrence, not just one time per block. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'000A'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Count of Write ERP actions (2-byte binary format)

X'000B'

Servo Demark Blocks Written

The count of servo demark blocks written. Multiple occurrences per block are not recorded. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'000B'
2	Parameter control byte (see Page 33)

3 Parameter length: X'02'
4-5 Count of servo demark blocks written (2-byte binary format)

X'000C'

VCR Write Errors

The count of write errors in the Volume Control Region. Each count represents one occurrence, not just one time per block. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'000C'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	VCR Write Error count (2-byte binary format)

X'000D'

Unused counter

Byte	Description
0-1	Parameter Code: X'000D'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Unused counter

X'000E'

Blocks Lifted

The total number of times the device had to lift and move a block. Each count represents one occurrence, not just one time per block. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'000E'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Blocks Lifted Error count (2-byte binary format)

X'000F'

Write Gap Misses

The number of times that the drive overran the buffer and had to stop and restart during a write. Each count represents one occurrence, not just one time per write.

Byte	Description
0-1	Parameter Code: X'000F'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Write Gap Miss count (2-byte binary format)

X'0010'

Unused counter

Byte	Description
0-1	Parameter Code: X'0010'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Unused counter

Log Page X‘34’: Read Forward Errors

Page code 34 contains detailed counters related to read operations. This page is reset when a cartridge is loaded.

Byte **Description**

0

Bit	Description
7-6	Reserved
5-0	Page Code: X'34'

1 Reserved

2-3 Page length:

The page length is determined by the parameters and the number of parameters selected for transmission to the initiator.

The following parameters are supported for the Read Forward Error page (page code X'34'):

Read errors are broken into nine main counters that are mutually exclusive.

X'0000'

Blocks Corrected

ECC is done “on the fly” by hardware. Each count represents one block in error that was successfully corrected and read. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0000'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Blocks corrected count (2-byte binary format)

X'0001'

Servo Transient Condition

ERP action was required because of a servo detected error and the first retry was successfully in place. Each count represents one block in error that was successfully recovered and read. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0001'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Servo transient condition count (2-byte binary format)

X'0002'

RDF/ECC Transient Conditions

ERP action was required because of a RDF (Read Data Flow) or ECC detected error and the first retry was successfully in place. Each count represents one block in error that was successfully recovered and read. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0002'
2	Parameter control byte (see Page 33)

3	Parameter length: X'02'
4-5	RDF/ECC transient condition count (2-byte binary format)

X'0003'

Read Velocity Errors

The count of detected read velocity errors. Each count represents one occurrence, not just the count of affected blocks. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0003'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Read Velocity Error Count (2-byte binary format)

X'0004'

Servo Data Acquisition Errors

A servo error (servo dropout or off track shutdown) was detected while trying to acquire an IBG or block, ERP action was required, and servo transient condition criteria were not met. Each count represents one block in error that was successfully recovered and read. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0004'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Servo data acquisition error count (2-byte binary format)

X'0005'

RDF Data Acquisition Errors

The RDF (Read Data Flow) failed to acquire an IBG or block, and no servo error was reported; ERP action was required, and RDF/ECC transient condition criteria were not met. Each count represents one block in error that was successfully recovered and read. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0005'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	RDF data acquisition error count (2-byte binary format)

X'0006'

Servo Data Errors

A servo error (servo drop out) was detected while reading a block; ERP action was required, and servo transient condition criteria were not met. Each count represents one block in error that was successfully recovered and read. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0006'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Servo data error count (2-byte binary format)

X'0007'

ECC Data Errors

An uncorrectable error, CRC error, or no ending burst error occurred while reading a block, and no servo error was reported; ERP action was required, and RDF/ECC transient condition criteria were not met. Each count represents one block in error that was successfully recovered and read. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0007'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ECC data error count (2-byte binary format)

X'0008'

Sequence Errors

A Block Id number out of sequence, and no Servo or RDF/ECC error reported; ERP action was required, and no transient condition criteria were not met. Each count represents one block in error that was successfully recovered and read. When multiple errors occur on a block, the counter that is updated is based on the first error detected.

Byte	Description
0-1	Parameter Code: X'0008'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Block ID Sequence Error count (2-byte binary format)

The following counts are included in the Read Errors Page as statistics regarding what specific ERP action or combination of actions appeared to have resulted in a successful recovery. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

X'0009'

Read Opposite

The block was recovered by reading in the opposite direction. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

Byte	Description
0-1	Parameter Code: X'0009'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Read Backward Recovery count (2-byte binary format)

X'000A'

Tension Adjust High

The tension adjusted higher than nominal. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

Byte	Description
0-1	Parameter Code: X'000A'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Tension Adjust High count (2-byte binary format)

X'000B'

Tension Adjust Low

The tension adjusted lower than nominal. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

Byte	Description
0-1	Parameter Code: X'000B'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Tension Adjust Low count (2-byte binary format)

X'000C'

Servo Adjust High

The track following servo offset high. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

Byte	Description
0-1	Parameter Code: X'000C'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Servo Adjust High (2-byte binary format)

X'000D'

Servo Adjust Low

The track following servo offset low. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

Byte	Description
0-1	Parameter Code: X'000D'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Servo Adjust Low (2-byte binary format)

X'000E'

Dead Reckon Nominal

Dead reckoning at nominal position. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

Byte	Description
0-1	Parameter Code: X'000E'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Dead Reckoning Nominal (2-byte binary format)

X'000F'

Dead Reckon High

Dead reckoning offset high. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

Byte	Description
0-1	Parameter Code: X'000F'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'

4-5 Dead Reckoning High (2-byte binary format)

X'0010'

Dead Reckon Low

Dead reckoning offset low. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

Byte	Description
0-1	Parameter Code: X'0010'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Dead Reckoning Low (2-byte binary format)

X'0011'

Filter Coefficients

Changed read filter coefficients. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

Byte	Description
0-1	Parameter Code: X'0011'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Read Filter Coefficients (2-byte binary format)

The following counts are included in the Read Errors Page as potentially useful information:

X'0012'

Opposite Gap

Block recovered by using opposite read gap. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

Byte	Description
0-1	Parameter Code: X'0012'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Opposite Read Gap (2-byte binary format)

X'0013'

Data Flow Clock Adjusted

Block was recovered by allowing the Read Data Flow to realign on different clock boundaries. Each count represents one block in error that was successfully recovered and read. However, more than one counter per block can be updated.

Byte	Description
0-1	Parameter Code: X'0013'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Data Flow Clock Adjustment count (2-byte binary format)

X'0014'

Unused counter

Byte	Description
0-1	Parameter Code: X'0014'

	2	Parameter control byte (see Page 33)
	3	Parameter length: X'02'
	4-5	Unused counter

X'0015'

Total Read Retries

The count of the total number of read ERP actions. Each count represents one occurrence, not just one time per block. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0015'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Total Read Retries (2-byte binary format)

X'0016'

Bellcord Actions

The count of read ERP actions based on error profiles. Each count represents one occurrence, not just one time per block. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0016'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Count of Read ERP actions (2-byte binary format)

X'0017'

VCR Read Errors

The count of read errors in the Volume Control Region. Each count represents one occurrence, not just one time per block. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0017'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	VCR Read Error count (2-byte binary format)

X'0018'

Cartridge Initialization Errors

The count of servo acquisition errors during tape load. Each count represents one occurrence, not just one time per block. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0018'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Cartridge Initialization Error count (2-byte binary format)

X'0019'

Read Gap Misses

The number of times that the drive overran the buffer and had to stop and restart during a read. Each count represents one occurrence, not just one time per read.

Byte	Description
0-1	Parameter Code: X'0019'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Read Gap Miss count (2-byte binary format)

X'001A'

Unused counter

Byte	Description
0-1	Parameter Code: X'001A'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Unused counter

X'001B'

Servo Demarks Read

The count of Servo Demark blocks read. Each count represents one occurrence, not just one time per block. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'001B'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Count of Servo Demark Blocks read (2-byte binary format)

X'001C'

Unused counter

Byte	Description
0-1	Parameter Code: X'001C'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Unused counter

Log Page X‘36’: Read Reverse Errors

Byte	Description
0	

Bit	Description
7-6	Reserved
5-0	Page Code: X'36'

1	Reserved
2-3	Page length:

The page length is determined by the parameters and the number of parameters selected for transmission to the initiator.

The parameters supported for the Read Reverse Error page (page code X'36') are identical to those described in “Log Page X‘34’: Read Forward Errors” on page 51, except that this data is recorded when the device is performing Read Reverse operations rather than Read Forward operations. This page is reset when a cartridge is loaded.

Log Page X‘38’: Blocks/Bytes Transferred

This page is reset when a cartridge is loaded.

Byte	Description

0

Bit	Description
7-6	Reserved
5-0	Page Code: X'38'

1 Reserved

2-3 Page length:

The page length is determined by the parameters and the number of parameters selected for transmission to the initiator.

The following parameters are supported for the Blocks/Bytes Transferred page (page code X'38'):

X'0000'

SCSI Write Blocks Processed

Each count represents a block processed across the SCSI interface during a Write. The count does not include ERP retries.

Byte	Description
0-1	Parameter Code: X'0000'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	SCSI write blocks processed (4-byte binary format)

X'0001'

SCSI Write Kilobytes Processed

Each count represents a kilobyte (1024 bytes) processed across the SCSI interface during a Write. The count does not include ERP retries. You can divide this count by Device Write Kilobytes Processed, X'0005', to calculate an approximate write compression ratio.

Byte	Description
0-1	Parameter Code: X'0001'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	SCSI write kilobytes processed (4-byte binary format)

Refer to “Scaled Log Page Counters” on page 239 for a description of this scaled counter.

X'0002'

SCSI Read Blocks Processed

Each count represents a block processed across the SCSI interface during a Read. The count does not include ERP retries.

Byte	Description
0-1	Parameter Code: X'0001'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	SCSI read blocks processed (4-byte binary format)

X'0003'

SCSI Read Kilobytes Processed

Each count represents a kilobyte (1024 bytes) processed across the SCSI interface during a Read. The count does not include ERP retries. You can divide this count by Device Read Kilobytes Processed, X'0007', to calculate an approximate read compression ratio.

Byte	Description
0-1	Parameter Code: X'0003'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	SCSI read kilobytes processed (4-byte binary format)

Refer to “Scaled Log Page Counters” on page 239 for a description of this scaled counter.

X'0004'

Device Write Blocks Processed

Each count represents a block processed on the medium. The count does not include ERP retries.

Byte	Description
0-1	Parameter Code: X'0004'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Device write blocks processed (4-byte binary format)

X'0005'

Device Write Kilobytes Processed

Each count represents a kilobyte (1024 bytes) processed on the medium. The count does not include ERP retries or any tape formatting overhead bytes.

Byte	Description
0-1	Parameter Code: X'0005'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Device write kilobytes recorded (4-byte binary format)

Refer to “Scaled Log Page Counters” on page 239 for a description of this scaled counter.

X'0006'

Device Read Blocks Processed

Each count represents a block read and processed from the medium. The count does not include ERP retries or overhead.

Byte	Description
0-1	Parameter Code: X'0006'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Device read blocks processed (4-byte binary format)

X'0007'

Device Read Kilobytes Processed

Each count represents a kilobyte (1024 bytes) read and processed from the medium. The count does not include ERP retries or overhead.

Byte	Description
0-1	Parameter Code: X'0007'
2	Parameter control byte (see Page 33)

3	Parameter length: X'04'
4-7	Device read kilobytes processed (4-byte binary format)

X'0008'

Device Write Blocks Transferred

Each count represents a block written and processed to the medium. The count includes ERP retries and repositioning.

Byte	**Description**
0-1	Parameter Code: X'0008'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Device write blocks transferred (4-byte binary format)

X'0009'

Device Write Kilobytes Transferred

Each count represents a kilobyte (1024 bytes) written and processed on the medium. The count includes ERP retries, and tape formatting overhead bytes.

Byte	**Description**
0-1	Parameter Code: X'0009'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Device write kilobytes transferred (4-byte binary format)

Refer to “Scaled Log Page Counters” on page 239 for a description of this scaled counter.

X'000A'

Device Read Blocks Transferred

Each count represents a block read and processed from the medium. The count includes ERP retries and repositioning.

Byte	**Description**
0-1	Parameter Code: X'000A'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Device read blocks transferred (4-byte binary format)

X'000B'

Device Read Kilobytes Transferred

Each count represents one byte read and processed from the medium. The count includes ERP retries and tape formatting overhead bytes.

Byte	**Description**
0-1	Parameter Code: X'000B'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Device read kilobytes transferred (4-byte binary format)

Refer to “Scaled Log Page Counters” on page 239 for a description of this scaled counter.

X'000C'

Nominal Capacity of Partition

Note: Partitioning of a volume is not currently supported, but may be in the future.

The nominal capacity of the current partition (in kilobytes).

Byte	Description
0-1	Parameter Code: X'000C'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Nominal capacity of partition in kilobytes (4-byte binary format)

Note: Partitioning of a volume is not currently supported, but may be in the future.

Refer to “Scaled Log Page Counters” on page 239 for a description of this scaled counter.

X'000D'

Fractional Part of Partition Currently Traversed

Note: Partitioning of a volume is not currently supported, but may be in the future.

The fractional part of the partition traversed (N/255).

Byte	Description
0-1	Parameter Code: X'000D'
2	Parameter control byte (see Page 33)
3	Parameter length: X'01'
4	Fraction of partition currently traversed (X'00 to FF')

X'000E'

Nominal Capacity of the Volume

The nominal capacity of the volume (in kilobytes)

Byte	Description
0-1	Parameter Code: X'000E'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Nominal capacity of volume in kilobytes (4-byte binary format)

Refer to “Scaled Log Page Counters” on page 239 for a description of this scaled counter.

X'000F'

Fractional Part of Volume Currently Traversed

The fractional part of the volume traversed (N/255).

Byte	Description
0-1	Parameter Code: X'000F'
2	Parameter control byte (see Page 33)
3	Parameter length: X'01'
4	Fraction of volume currently traversed (X'00 to FF')

Log Page X‘39’: SCSI Port 0 Interface Errors

The count of errors occurring on SCSI port 0 (while the 3590 drive is active on the bus). This page is reset when a cartridge is loaded.

Byte	Description
0	

Bit	Description
7-6	Reserved
5-0	Page Code: X'39'

1	Reserved
2-3	Page length:

The page length is determined by the parameters and the number of parameters selected for transmission to the initiator.

The following parameters are supported for the SCSI Port 0 Interface Errors page (page code X'39'):

X'0000'

SCSI Protocol Errors

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0000'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	SCSI protocol errors (2-byte binary format)

X'0007'

SCSI Aborts

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0007'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	SCSI aborts (2-byte binary format)

X'0008'

SCSI Bus Resets

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0008'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	SCSI bus resets (2-byte binary format)

X'0009'

Reserved

Byte	Description
0-1	Parameter Code: X'0009'
2	Parameter control byte (see Page 33)

3	Parameter length: X'02'
4-5	Reserved (2-byte binary format)

X'000A'

Reserved

Byte	Description
0-1	Parameter Code: X'000A'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Reserved (2-byte binary format)

Log Page X‘3A’: SCSI Port 1 Interface Errors

The count of errors occurring on SCSI port 1 (while the 3590 drive is active on the bus). This page is reset when a cartridge is loaded.

Byte	Description
0	

Bit	Description
7-6	Reserved
5-0	Page Code: X'3A'

1	Reserved
2-3	Page length: The page length is determined by the parameters and the number of parameters selected for transmission to the initiator.

The following parameters are supported for the SCSI Port 1 Interface Errors page (page code X'3A'):

Note: The parameters are identical to those found in “Log Page X‘39’: SCSI Port 0 Interface Errors” on page 63, except this data is recorded when the device is using interface 1.

Log Page X‘3B’: Equipment Check Errors

The following counters all deal with errors where a logic problem in the drive hardware is suspected (as opposed to errors with write or read data to or from the tape or the SCSI bus). This page is reset when a cartridge is loaded.

Byte	Description
0	

Bit	Description
7-6	Reserved
5-0	Page Code: X'3B'

1	Reserved
2-3	Page length:

The page length is determined by the parameters and the number of parameters selected for transmission to the initiator.

The following parameters are supported for the Equipment Check Errors page (page code X'3B'):

X'0001'

Operator Panel Errors

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0001'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Operator panel errors (2-byte binary format)

X'0002'

SCSI Protocol Chip Errors

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0002'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	SCSI protocol chip errors (2-byte binary format)

X'0003'

SCSI Buffer Errors

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0003'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	SCSI buffer errors (2-byte binary format)

X'0004'

Compactor Errors

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0004'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Compactor errors (2-byte binary format)

X'0005'

Format Buffer Errors

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0005'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Format buffer errors (2-byte binary format)

X'0006'

Data Flow Hardware Errors

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0006'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Data flow hardware errors (2-byte binary format)

X'0007'

ECC Hardware Errors

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0007'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ECC hardware errors (2-byte binary format)

X'0008'

Analog Card Hardware Errors

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0008'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	Analog card hardware errors (2-byte binary format)

X'0009'

Mailbox Interface Errors

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0009'
2	Parameter control byte (see Page 33)

3 Parameter length: X'02'
4-5 Mailbox interface errors (2-byte binary format)

Log Page X‘3D’: Subsystem Statistics

The following counters all deal with Subsystem statistics and errors. This page is never reset. The counters are maintained in VPD and persist across Log Selects, Log Sense, Power On Resets, and even microcode download. Current values are written to VPD every eight operating hours when the drive is in a not ready state. The user may also save these counters to VPD at other times (such as just prior to powering off) by selecting the *Save* option from the operator panel Statistics menu. The counters lock at maximum values.

Note: The page is currently returned; however, more fields may be supported in the future.

Byte	Description
0	

Bit	Description
7-6	Reserved
5-0	Page Code: X'3D'

1	Reserved
2-3	Page length:

The page length is determined by the parameters and the number of parameters selected for transmission to the initiator.

The following parameters are supported for the Subsystems Statistics Page (page code X'3D'):

X'0000'

ACF Errors

Each count represents one occurrence. Counts may include occurrences from both temporary and permanent errors.

Byte	Description
0-1	Parameter Code: X'0000'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF errors (2-byte binary format)

X'0001'

ACF Failures of Put to Drive Actions

Each count represents one occurrence where a ACF attempt to move a cartridge to the drive failed.

Byte	Description
0-1	Parameter Code: X'0001'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF put to drive failures (2-byte binary format)

X'0002'

ACF Failures of Get from Drive Actions

Each count represents one occurrence where a ACF attempt to remove a cartridge from the drive failed.

Byte	Description
0-1	Parameter Code: X'0002'
2	Parameter control byte (see Page 33)

3	Parameter length: X'02'
4-5	ACF get from drive failures (2-byte binary format)

X'0003'

ACF Failures of Put to Magazine Actions

Each count represents one occurrence where a ACF attempt to move a cartridge to the magazine failed.

Byte	**Description**
0-1	Parameter Code: X'0003'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF put to magazine failures (2-byte binary format)

X'0004'

ACF Failures of Get from Magazine Actions

Each count represents one occurrence where a ACF attempt to remove a cartridge from the magazine failed.

Byte	**Description**
0-1	Parameter Code: X'0004'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF get from magazine failures (2-byte binary format)

X'0005'

ACF Failures of Put to Priority Cell Actions

Each count represents one occurrence where a ACF attempt to move a cartridge to the priority cell failed.

Byte	**Description**
0-1	Parameter Code: X'0005'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF put to priority cell failures (2-byte binary format)

X'0006'

ACF Failures of Get from Priority Cell Actions

Each count represents one occurrence where a ACF attempt to remove a cartridge from the priority cell failed.

Byte	**Description**
0-1	Parameter Code: X'0006'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF get from priority cell failures (2-byte binary format)

X'0007'

ACF Pinch Motor Errors

Each count represents one occurrence of a ACF pinch motor error.

Byte	**Description**
0-1	Parameter Code: X'0007'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF pinch motor errors (2-byte binary format)

X'0008'

ACF Feed Motor Errors

Each count represents one occurrence of a ACF feed motor error.

Byte	Description
0-1	Parameter Code: X'0008'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF feed motor errors (2-byte binary format)

X'0009'

ACF Elevator Motor Errors

Each count represents one occurrence of a ACF elevator motor error.

Byte	Description
0-1	Parameter Code: X'0009'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF elevator motor errors (2-byte binary format)

X'000A'

ACF Moves

Each count represents a move from one cell to a different cell. Cells may be Storage cells, Data cells, or Import/Export cells.

Byte	Description
0-1	Parameter Code: X'000A'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF moves (2-byte binary format)

X'000B'

ACF Recalibrations

Each count represents one occurrence of a ACF calibration.

Byte	Description
0-1	Parameter Code: X'000B'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF recalibrations (2-byte binary format)

X'000C'

ACF Drive Mounts

Each count represents one occurrence of a ACF mount to drive.

Byte	Description
0-1	Parameter Code: X'000C'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF mounts to drive (2-byte binary format)

X'000D'

ACF Priority Cell Mounts

Each count represents one occurrence of a ACF mount from the Priority cell.

Byte	Description
0-1	Parameter Code: X'000D'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF mounts using the priority cell (2-byte binary format)

X'000E'

ACF Magazine Cell Mounts

Each count represents one occurrence of a ACF mount from a magazine cell.

Byte	Description
0-1	Parameter Code: X'000E'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF mounts using the magazine cell (2-byte binary format)

X'000F'

ACF Cleaning Mounts to Device

Each count represents one mount of the cleaning cartridge into the device. All cleaning mounts are counted regardless of whether a ACF was configured with the drive or not. In particular cleaning mounts in a 3494 library are counted.

Byte	Description
0-1	Parameter Code: X'000F'
2	Parameter control byte (see Page 33)
3	Parameter length: X'02'
4-5	ACF cleaning cartridge mounts (2-byte binary format)

X'0020'

Volume Lifetime Mounts

The count represents the total number of successful cartridge unloads performed during the lifetime of a cartridge. This field is not updated for those mounts that occur with the volume physically write-protected.

Byte	Description
0-1	Parameter Code: X'0020'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Volume lifetime mounts

X'0021'

Volume Lifetime Megabytes Written

The count represents the total number of bytes in Megabytes written during the lifetime of the cartridge. On each unload, an approximate value is calculated and stored by rounding up to the nearest Megabyte. These bytes are counted as they are processed to the medium (compressed bytes), not at the SCSI interface. This field is not updated during those mounts that occur with the volume physically write-protected.

Byte	Description
0-1	Parameter Code: X'0021'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Volume lifetime Megabytes written

X'0022'

Volume Lifetime Megabytes Read

The count represents the total number of bytes in Megabytes read during the lifetime of the cartridge. On each unload, an approximate value is calculated and stored by rounding up to the nearest Megabyte. These bytes are counted as they are processed to the medium (compressed bytes), not

at the SCSI interface. This field is not updated during those mounts that occur with the volume physically write-protected.

Byte	Description
0-1	Parameter Code: X'0022'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Volume lifetime Megabytes read

X'0040'

Drive Lifetime Mounts

Each count represents the total number of successful cartridge unloads performed during the lifetime of the drive.

Byte	Description
0-1	Parameter Code: X'0040'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Volume lifetime mounts

X'0041'

Drive Lifetime Megabytes Written

The count represents the total number of bytes in Megabytes written during the lifetime of the drive. On each unload, an approximate value is calculated and stored by rounding up to the nearest Megabyte. These bytes are counted as they are processed to the medium (compressed bytes), not at the SCSI interface.

Byte	Description
0-1	Parameter Code: X'0041'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Drive lifetime Megabytes written

X'0042'

Drive Lifetime Megabytes Read

The count represents the total number of bytes in Megabytes read during the lifetime of the drive. On each unload, an approximate value is calculated and stored by rounding up to the nearest Megabyte. These bytes are counted as they are processed to the medium (compressed bytes), not at the SCSI interface.

Byte	Description
0-1	Parameter Code: X'0042'
2	Parameter control byte (see Page 33)
3	Parameter length: X'04'
4-7	Drive lifetime Megabytes read

Mode Select (6) - X‘15’

The Mode Select (6) command is supported by the 3590 drive. Table 13 shows the command format.

Note: In the future, the length of the mode parameter list for Mode Sense Page Code X'3F' (return all pages) may exceed 255 bytes. At that time, use of the Mode Select (10) and Mode Sense (10) commands will be required in order to transfer all mode pages with one command. For this reason, use of the Mode Select (6) and Mode Sense (6) commands is not recommended.

Table 13. Mode Select (6) Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'15')							
1	Logical Unit Number			PF	Reserved			SP
2	Reserved							
3	Reserved							
4	Parameter List Length							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Mode pages X'01', X'02', X'0A', X'0F',X'10', X'11', X'20', X'21', X'22', X'23', X'24', and X'25' are supported by both B-Series Models and E-Series Models. Mode pages X'18' and X'19' are supported only when Fibre Channel is attached. B-Series Models also support Mode pages X'1D', X'1E', X'1F' on both the Drive and Medium Changer LUNs. E-Series Models support these three Mode Pages only on the Medium Changer LUN. The following 3590-specific parameters apply:

- PF (Page Format): B'1'

  The PF (Page Format) bit is explicitly **not** checked.
- SP (Save Pages): B'0'
- Parameter List Length:

  This field specifies the length in bytes of the mode parameter list that is transferred from the initiator to the target. A parameter list length of zero indicates that no data is transferred. This condition is not considered as an error.

  The target terminates the command with CHECK CONDITION status with associated sense data of 5/1A00 (Illegal Request, Parameter List Length Error) if the parameter list length results in the truncation of the mode parameter header, the mode parameter block descriptor, or any mode page.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Note: Issuing a Mode Sense for current values before a Mode Select is generally recommended to avoid accidentally attempting to set fields that cannot be changed by the initiator.

Changing some Mode Page X'23' and Mode Page X'10' parameters causes an implicit write to tape. B-Series models write using B-Format (density code X'29') and E-Series models write using E-Format (density code X'2A'). At Beginning Of Tape, any tape written in one format can be changed to another format when an Erase, Write, or Write Filemarks command is issued. If an attempt is made by an E-Series model to change some Mode Page X'23' or Mode Page X'10' parameter on a B-Format tape (even when at Beginning Of Tape), CHECK CONDITION status is

returned with associated sense data of 5/3005 (Illegal Request, Cannot Write Medium — Incompatible Format). Since a B-Series model cannot read an E-Format tape, this condition cannot happen on a B-Series model.

Listed below are the Mode Parameters that cause implicit writes:

- Mode Page 10, Byte 15, Bit 1 PERSWP
- Mode Page 10, Byte 15, Bit 0 PRMWP
- Mode Page 23, Byte 10, Bit 4 Persistent Write Protect
- Mode Page 23, Byte 10, Bit 3 Reset Persistent Write Protect
- Mode Page 23, Byte 10, Bit 0 Permanent Write Protect
- Mode Page 23, Byte 11, Bit 0 CapScalV
- Mode Page 23, Byte 20, Bit 0 Edge Track

Note: For Reserved-Vendor-Unique fields, appropriate values to issue on a Mode Select may be non-zero. Mode Selects to pages with these fields should use a value obtained by issuing a Mode Sense just prior to the Mode Select.

Mode Parameter List for Mode Select (6)

The mode pages are preceded by a 4-byte mode parameter header (see “Mode Parameter Header for Mode Select (6)” on page 77) and an optional 8-byte block descriptor (see “Block Descriptor for Mode Select (6) or Mode Select (10)” on page 78). Mode page descriptions begin at “Mode Page X‘01’: Read-Write Error Recovery” on page 93

Table 14 shows the format of the mode parameter list.

Table 14. Mode Parameter List for Mode Select (6)

Bit **Byte**	**7** **MSB**	**6**	**5**	**4**	**3**	**2**	**1**	**0** **LSB**
0-3	Mode Parameter Header							
4-11	Block descriptor (if Block Descriptor Length is X'08.')							
4-n or 12-n	Mode Pages							

Mode Parameter Header for Mode Select (6)

There is one copy of the mode parameter header for each initiator. Table 15 shows the format of the mode parameter header for Mode Select (6).

Table 15. Mode Parameter Header for Mode Select (6)

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Mode Data Length (Reserved for Mode Select)							
1	Medium Type							
2	Device-Specific Parameter							
3	Block Descriptor Length							

Mode parameter header field descriptions follow:

Byte **Description**

0 Reserved

1 Medium Type: Any value is allowed and ignored.

2 Device-Specific Parameter - Sequential Access Devices

Bit **Description**
7 Undefined (field is ignored)
6-4 Buffered Mode

Value **Description**
0 Good status is reported when data is on medium
1 Good status is reported when data is in the buffer
2 Good status is reported when data is in the buffer and data from other initiators is written on medium
3-7 Reserved

This field is changeable. The default value for this field is 1.
3-0 Speed: X'0' (use default speed)

3 Block Descriptor Length:
- Set to X'00' if no block descriptor follows.
- Set to X'08' if a single block descriptor follows.

This is a changeable field.

Block Descriptor for Mode Select (6) or Mode Select (10)

The presence of the block descriptor in the Mode Select command depends on the value of the Block Descriptor Length in the mode parameter header. There is one copy of the block descriptor for each initiator. Table 16 shows the format of the block descriptor.

Table 16. Block Descriptor for Mode Select (6) or Mode Select (10)

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Density Code							
1-3	Number of Blocks							
4	Reserved							
5-7	Block Length							

The block descriptor field definitions follow:

Byte **Description**

0 Density Code:

Value	Description
X'00'	Use default density code
X'29'	Use 3590 B-Format density code
X'2A'	Use 3590 E-Format density code (E-Series Models only)
X'7F'	No change from previous density - NOP

A Change to this field is allowed and ignored.

1-3 Number of Blocks: X'000000'

4 Reserved

5-7 Block Length:

Block length is a changeable field. Any value of block length can be specified between the minimum and the maximum block lengths, inclusive, specified in the Read Block Limits command. A Block Length value of X'000000' indicates that the logical block size to be written to or read from the medium is specified by the Transfer Length field in the CDB (see “Read - X‘08’” on page 131 and “Write - X‘0A’” on page 185).

Mode Select (10) - X‘55’

The Mode Select (10) command is supported by the 3590 drive. Table 17 shows the command format.

Table 17. Mode Select (10) Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'55')							
1	Logical Unit Number			PF	Reserved			SP
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Parameter List Length							
8								
9	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Mode pages X'01', X'02', X'0A', X'0F', X'10', X'11', X'20', X'21', X'22', X'23', X'24', and X'25' are supported by both B-Series Models and E-Series Models. Mode pages X'18' and X'19' are supported only when Fibre Channel is attached. B-Series Models also support Mode pages X'1D', X'1E', X'1F' on both the Drive and Medium Changer LUNs. E-Series Models support these three Mode Pages only on the Medium Changer LUN. The following 3590-specific parameters apply:

- PF (Page Format): B'1'

  The PF (Page Format) bit is explicitly **not** checked.
- SP (Save Pages): B'0'
- Parameter List Length:

  This field specifies the length in bytes of the mode parameter list that is transferred from the initiator to the target. A parameter list length of zero indicates that no data is transferred. This condition is not considered as an error.

  The target terminates the command with CHECK CONDITION status with associated sense data of 5/1A00 (Illegal Request, Parameter List Length Error) if the parameter list length results in the truncation of the mode parameter header, the mode parameter block descriptor, or any mode page.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Note:

Issuing a Mode Sense for current values before a Mode Select is generally recommended to avoid accidentally attempting to set fields that cannot be changed by the initiator.

Changing some Mode Page X'23' and Mode Page X'10' parameters causes an implicit write to tape. B-Series models write using B-Format (density code X'29') and E-Series models write using E-Format (density code X'2A'). At Beginning of Tape, any tape written in one format can be changed to another format when an Erase, Write, or Write Filemarks command is issued. If an attempt is made by an E-Series model to change some Mode Page X'23' or

Mode Page X'10' parameter on a B-Format tape (even when at Beginning Of Tape), CHECK CONDITION status is returned with associated sense data of 5/3005 (Illegal Request, Cannot Write Medium — Incompatible Format). Since a B-Series model cannot read an E-Format tape, this condition cannot happen on a B-Series model.

Listed below are the Mode Parameters that cause implicit writes:

- Mode Page 10, Byte 15, Bit 1 PERSWP
- Mode Page 10, Byte 15, Bit 0 PRMWP
- Mode Page 23, Byte 10, Bit 4 Persistent Write Protect
- Mode Page 23, Byte 10, Bit 3 Reset Persistent Write Protect
- Mode Page 23, Byte 10, Bit 0 Permanent Write Protect
- Mode Page 23, Byte 11, Bit 0 CapScalV
- Mode Page 23, Byte 20, Bit 0 Edge Track

Note: For Reserved-Vendor-Unique fields, appropriate values to issue on a Mode Select may be non-zero. Mode Selects to pages with these fields should use a value obtained by issuing a Mode Sense just prior to the Mode Select.

Mode Parameter List for Mode Select (10)

The mode pages are preceded by a 8-byte mode parameter header (see “Mode Parameter Header for Mode Select (10)” on page 82) and an optional 8-byte block descriptor (see “Block Descriptor for Mode Select (6) or Mode Select (10)” on page 78). Mode page descriptions begin at “Mode Page X‘01’: Read-Write Error Recovery” on page 93.

Table 18 shows the format of the mode parameter list.

Table 18. Mode Parameter List for Mode Select (10)

Bit **Byte**	**7** **MSB**	**6**	**5**	**4**	**3**	**2**	**1**	**0** **LSB**
0-7	Mode Parameter Header							
8-15	Block descriptor (if Block Descriptor Length is X'08.')							
8-n or 16-n	Mode Pages							

Mode Parameter Header for Mode Select (10)

There is one copy of the mode parameter header for each initiator. Table 19 shows the format of the mode parameter header for Mode Select (10).

Table 19. Mode Parameter Header for Mode Select (10)

Bit / Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Mode Data Length (Reserved for Mode Select)							
1								
2	Medium Type							
3	Device-Specific Parameter							
4	Reserved							
5	Reserved							
6	Block Descriptor Length							
7								

Mode parameter header field descriptions follow:

Byte **Description**

0-1 Reserved

2 Medium Type: Any value is allowed and ignored.

3 Device-Specific Parameter - Sequential Access Devices

Bit **Description**
7 Undefined (field is ignored)
6-4 Buffered Mode

Value **Description**
0 Good status is reported when data on medium
1 Good status is reported when data is in buffer
2 Good status is reported when data in buffer and data from other initiators is written on medium
3-7 Reserved

This field is changeable. The default value for this field is 1.
3-0 Speed: X'0' (use default speed)

4-5 Reserved

6-7 Block Descriptor Length:
- Set to X'0000' if no block descriptor follows.
- Set to X'0008' if a single block descriptor follows.

This is a changeable field.

Mode Sense (6) - X‘1A’

The Mode Sense (6) command is supported by the 3590 drive. Table 20 shows the command format.

Note: In the future, the length of the mode parameter list for Mode Sense Page Code X'3F' (return all pages) may exceed 255 bytes. At that time, use of the Mode Select (10) and Mode Sense (10) commands will be required in order to transfer all mode pages with one command. For this reason, use of the Mode Select (6) and Mode Sense (6) commands is not recommended.

Table 20. Mode Sense (6) Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1A')							
1	Logical Unit Number			Reserved	DBD	Reserved		
2	PC		Page Code					
3	Reserved							
4	Allocation Length							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- DBD (Disable Block Descriptors): B'0' or B'1'. (See Block Descriptor Length, below.)
- PC (Page Control): B'00', B'01', or B'10' supported
- Mode pages X'01', X'02', X'0A', X'0F',X'10', X'11', X'20', X'21', X'22', X'23', X'24', X'25', and X'3F' (return all pages) are supported by both B-Series Models and E-Series Models. Mode pages X'18' and X'19' are supported only when Fibre Channel is attached. B-Series Models also support Mode pages X'1D', X'1E', X'1F' on both the Drive and Medium Changer LUNs. E-Series Models support these three Mode Pages only on the Medium Changer LUN.
- Allocation Length: The maximum number of bytes to be transferred.

  If the allocation length specified is less than the amount available, then the allocated amount is transferred and no error is reported.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Mode Parameter List for Mode Sense (6)

The mode pages are preceded by a 4-byte mode parameter header (see “Mode Parameter Header for Mode Sense (6)” on page 85) and an optional block descriptor. If the DBD field is B'0', an 8-byte block descriptor follows the mode parameter header (see “Block Descriptor for Mode Sense (6) or Mode Sense (10)” on page 86). If the DBD field is B'1', the block descriptor is not present and the first mode page follows the mode parameter header. Mode page descriptions begin at “Mode Page X‘01’: Read-Write Error Recovery” on page 93.

Table 21 shows the format of the mode parameter list.

Table 21. Mode Parameter List for Mode Sense (6)

Bit **Byte**	**7** **MSB**	**6**	**5**	**4**	**3**	**2**	**1**	**0** **LSB**
0-3	Mode Parameter Header							
4-11	Block descriptor (if DBD is set to B'0')							
4-n or 12-n	Mode Pages							

Mode Parameter Header for Mode Sense (6)

There is one copy of the mode parameter header for each initiator. Table 22 shows the format of the mode parameter header for Mode Sense (6).

Table 22. Mode Parameter Header for Mode Sense (6)

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Mode Data Length							
1	Medium Type							
2	Device-Specific Parameter							
3	Block Descriptor Length							

Mode parameter header field descriptions follow:

Byte **Description**

0 Mode data length

The length in bytes of the following data that is available to be transferred. (The mode data length does not include itself; that is, the length value is 1 less than the total length of the data available for transfer.)

1 Medium Type:

Value	Description
X'00'	No medium present or the drive does not support Extended High Performance Cartridge Tape
X'81'	Medium present is High Performance Cartridge Tape
X'82'	Medium present is Extended High Performance Cartridge Tape

2 Device-Specific Parameter - Sequential Access Devices

Bit **Description**

7 WP (Write Protect):
- B'0': indicates that the medium is not write protected
- B'1': indicates that the medium is write protected

Note: For the Mode Select commands, this field is ignored.

6-4 Buffered Mode

Value	Description
0	Good status is reported after data is on the medium
1	Good status is reported after data is in the buffer
2	Good status is reported after data is in the buffer and data from other initiators is written on the medium
3-7	Reserved

This field is changeable. The default value for this field is 1.

3-0 Speed: X'0' (use default speed)

3 Block Descriptor Length:
- If DBD = B'0', the Block Descriptor Length field is set to X'08' and a block descriptor follows.
- If DBD = B'1', the Block Descriptor Length field is set to X'00' and no block descriptor follows.

Block Descriptor for Mode Sense (6) or Mode Sense (10)

The presence of the block descriptor in the Mode Sense command depends on the value of the DBD bit in the CDB. There is one copy of the block descriptor for each initiator. Table 23 shows the format of the block descriptor.

Table 23. Block Descriptor for Mode Sense (6) or Mode Sense (10)

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Density Code							
1	Number of Blocks							
2								
3								
4	Reserved							
5	Block Length							
6								
7								

The block descriptor definition follows:

Byte **Description**

0 Density Code:

Value **Description**

X'00' Medium present unidentified for one of the following reasons:

- No medium present
- On B-Series Models only, the drive does not support Extended High Performance Cartridge Tape
- On B-Series Models only, the medium present was last written by an E-Series model (E-Format)

X'29' Medium present was last written on a B-Series model (B-Format) and is one of the following:

- High Performance Cartridge Tape with 10GB native capacity
- Extended High Performance Cartridge Tape with 20GB native capacity

X'2A' Medium present was last written on a E-Series model (E-Format) and is one of the following (reported by E-Series model only):

- High Performance Cartridge Tape with 20GB native capacity
- Extended High Performance Cartridge Tape Tape with 40GB native capacity

Note: B-Series drives can read or write only B-Format density. E-Series drives can read B-Format density and can read or write E-Format density. Any drive can write any tape when at Beginning of Tape. Once the write at BOT is done, the Density Code will change implicitly to the appropriate value.

1-3 Number of Blocks: X'000000'

4 Reserved

5-7 Block Length:

Block length is a changeable field. Any value of block length can be specified between the minimum and the maximum block lengths, inclusive,

specified in the Read Block Limits command. A Block Length value of X'000000' indicates that the logical block size to be written to or read from the medium is specified by the Transfer Length field in the CDB (see “Read - X‘08’” on page 131 and “Write - X‘0A’” on page 185).

Mode Sense (10) - X‘5A’

The Mode Sense (10) command is supported by the 3590 drive. Table 24 shows the command format.

Table 24. Mode Sense (10) Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'5A')							
1	Logical Unit Number			Reserved	DBD	Reserved		
2	PC		Page Code					
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Allocation Length							
8								
9	Vendor Specific (B'00')							
			Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- DBD (Disable Block Descriptors): B'0' or B'1'. (See Block Descriptor Length, below.)
- PC (Page Control): B'00', B'01'; or B'10' supported
- Mode pages X'01', X'02', X'0A', X'0F',X'10', X'11', X'20', X'21', X'22', X'23', X'24', X'25', and X'3F' (return all pages) are supported by both B-Series Models and E-Series Models. Mode pages X'18' and X'19' are supported only when Fibre Channel is attached. B-Series Models also support Mode pages X'1D', X'1E', and X'1F' on both the Drive and Medium Changer LUNs. E-Series Models support these three Mode Pages only on the Medium Changer LUN.
- Allocation Length: The maximum number of bytes to be transferred.

  If the allocation length specified is less than the amount available, then the allocated amount is transferred and no error is reported.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Mode Parameter List for Mode Sense (10)

The mode pages are preceded by an 8-byte mode parameter header (see “Mode Parameter Header for Mode Sense (10)” on page 90) and an optional block descriptor. If the DBD field is B'0', an 8-byte block descriptor follows the mode parameter header (see “Block Descriptor for Mode Sense (6) or Mode Sense (10)” on page 86). If the DBD field is B'1', the block descriptor is not present and the first mode page follows the mode parameter header. Mode page descriptions begin at “Mode Page X‘01’: Read-Write Error Recovery” on page 93.

Table 25 shows the format of the mode parameter list.

Table 25. Mode Parameter List for Mode Sense (10)

Bit **Byte**	**7** **MSB**	**6**	**5**	**4**	**3**	**2**	**1**	**0** **LSB**
0-7	Mode Parameter Header							
8-16	Block descriptor (if DBD is set to B'0')							
8-n or 16-n	Mode Pages							

Mode Parameter Header for Mode Sense (10)

There is one copy of the mode parameter header for each initiator. Table 26 shows the format of the mode parameter header for Mode Sense (10).

Table 26. Mode Parameter Header for Mode Sense (10)

Bit / Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Mode Data Length							
1								
2	Medium Type							
3	Device-Specific Parameter							
4	Reserved							
5	Reserved							
6	Block Descriptor Length							
7								

Mode parameter header field descriptions follow:

Byte **Description**

0-1 Mode data length

The length in bytes of the following data that is available to be transferred. (The mode data length does not include itself; that is, the length value is 1 less than the total length of the data available for transfer.)

2 Medium Type:

Value	Description
X'00'	No medium present or the drive does not support Extended High Performance Cartridge Tape
X'81'	Medium present is High Performance Cartridge Tape
X'82'	Medium present is Extended High Performance Cartridge Tape

3 Device-Specific Parameter - Sequential Access Devices

Bit	Description
7	WP (Write Protect): • B'0': indicates that the medium is not write protected • B'1': indicates that the medium is write protected **Note:** For the Mode Select commands, this field is ignored.
6-4	Buffered Mode

Value	Description
0	Good status is reported after data is on the medium
1	Good status is reported after data is in the buffer
2	Good status is reported after data is in the buffer and data from other initiators is written on the medium
3-7	Reserved

This field is changeable. The default value for this field is 1.

3-0 Speed: X'0' (use default speed)

4-5 Reserved

6-7 Block Descriptor Length:

- If DBD = B'0', the Block Descriptor Length field is set to X'0008' and a block descriptor follows.
- If DBD = B'1', the Block Descriptor Length field is set to X'0000' and no block descriptor follows.

Mode Page Format

Table 27 shows the format of the mode parameter list. The individual mode page descriptions that follow this table include the field descriptions. Each field is non-changeable unless specifically identified otherwise.

Table 27. Mode Page Format

Bit **Byte**	**7** **MSB**	**6**	**5**	**4**	**3**	**2**	**1**	**0** **LSB**
0	PS	Reserved	Page Code					
1	Page Length (n-1)							
2	Mode Parameters							
n								

Mode Page X‘01’: Read-Write Error Recovery

This page is defined as common to all initiators.

Byte **Description**

0

Bit	Description
7	PS (Parameter Saveable): B'0'
6	Reserved
5-0	Page Code: X'01'

1 Page Length: X'0A'

2

Bit	Description
7-6	Reserved
5	TB (Transfer Block): B'1'
4	Reserved
3	EER (Enable Early Recovery): B'1'
2	PER (Post Error): • B'0': The device does not create CHECK CONDITION status for recovered errors except for non-deferred sense data of – 1/0017 (Recovered Error, Warning: Drive Needs Cleaning) for a Load Unload command, – 1/3700 (Recovered Error, Rounded Parameter) for a Mode Select command, and – 1/8383 (Recovered Error, Drive Has Been Cleaned) for a Load Unload command. For reporting of VCR errors, see “Mode Page X‘25’: Read/Write Control” on page 124. • B'1': The device will report a CHECK CONDITION status for all recovered data and non-data errors with a sense key of 1 in non-deferred sense data as well as deferred sense data. This field is changeable. The default value is B'0'.
1	DTE (Disable Transfer on Error): Any value is allowed and ignored for this field. The default value is B'0'.
0	DCR (Disable Correction): B'0'

3 Read Retry Count

Value	Description
X'05'	Limited error recovery; < 5 seconds.
X'FF'	Full Recovery Routines allowed.

This field is changeable. The default value is X'FF'. The device rounds all other values to X'05'.

4-7 Reserved

8 Write Retry Count

Value	Description
X'05'	Limited error recovery; < 5 seconds.
X'FF'	Full Recovery Routines allowed.

This field is changeable. The default value is X'FF'. The device rounds all other values to X'05'.

9-11 Reserved

Mode Page X‘02’: Disconnect-Reconnect

There is one copy of this page for each initiator.

Byte	Description
0	

Bit	Description
7	PS: B'0'
6	Reserved
5-0	Page Code: X'02'

1	Page Length: X'0E'
2	Buffer Full Ratio: X'00'
3	Buffer Empty Ratio: X'00'
4-5	Bus Inactivity Limit: X'0000' (no limit)
6-7	Disconnect Time Limit: X'0000' (no limit)
8-9	Connect Time Limit: X'0000' (no limit)
10-11	Maximum Burst Size: SCSI - X'0000' (no limit) Any value is allowed and ignored for this field. X'0000' is the default value. Fibre Channel - Any value is allowed.
12	

Bit	Description
7	EMDP (Enable Modify Data Pointers): B'0'
6	FARd (Fair Arbitration Read): B'0'
5	FAWrt (Fair Arbitration Write): B'0'
4	FAStat (Fair Arbitration Status): B'0'
3	Dimm (Disconnect Immediate): B'0'
2-0	DTDC (Data Transfer Disconnect Word): B'000'

13	Reserved
14-15	First Burst Size: X'0000'

Mode Page X‘0A’: Control Mode

There is one copy of this page for each initiator.

Byte **Description**

0

Bit	Description
7	PS: B'0'
6	Reserved
5-0	Page Code: X'0A'

1 Page Length: X'0A'

2

Bit	Description
7-5	TST (Task Set Type): B'000'
4-2	Reserved
1	GLTSD (Global Logging Target Save Disable): B'0'

3

Bit	Description
7-4	Queue Algorithm Modifier: B'0000'
3-2	Reserved
1	QErr (Queue Error): B'0'
0	DQue (Disable Queuing): B'1'

Note: The 3590 drive does not support tagged queuing.

4

Bit	Description
7	Reserved
6	RAC (Report A Check): B'0'
5-3	Reserved
2	RAERP (Ready Asynchronous Event Reporting): B'0'
1	UAAERP (Unit Attention Asynchronous Event Reporting): B'0'
0	EAERP (Error Asynchronous Event Reporting): B'0'

5 Reserved

6-7 Ready AEN Holdoff Period: X'0000'

If AEN is disabled (Byte 4 bit 2 = 0), this field is not meaningful.

8-9 Busy timeout period: X'FFFF'

10 Reserved

11 Reserved

Mode Page X‘0F’: Data Compression

See *SCSI—3 Stream Commands [t10–997D] (hereafter referred to as the “NCITS SSC document”)*

This page is defined as common to all initiators.

Byte **Description**

0

Bit	Description
7	PS: B'0'
6	Reserved
5-0	Page Code: X'0F'

1 Page Length: X'0E'

2

Bit	Description
7	DCE (Data Compression Enabled): • B'0' Data compression is not enabled • B'1' Data compression is enabled This field is changeable. The default value is B'1'.
6	DCC (Data Compression Capable): B'1'
5-0	Reserved

3

Bit	Description
7	DDE: B'1'
6-5	RED (Report Exception on Decompression): B'00'
4-0	Reserved

4-7 Compression Algorithm: X'000000FF' (Unregistered algorithm)

8-11 Decompression Algorithm: X'000000FF' (Unregistered algorithm)

12 Reserved

13 Reserved

14 Reserved

15 Reserved

Mode Page X‘10’: Device Configuration

This page is defined as common to all initiators.

Byte **Description**

0

Bit	Description
7	PS: B'0'
6	Reserved
5-0	Page Code: X'10'

1 Page Length: X'0E'

2

Bit	Description
7	Reserved
6	CAP (Change Active Partition): • B'0': No partition change is specified. • B'1': Logical partition is to be changed to the partition specified in the Active Partition field. **Note:** Partitioning of a volume is not currently supported, but may be in the future. This is a changeable field. The default value is B'0'.
5	CAF (Change Active Format): B'0'
4-0	Active Format: B'00000'

3 Active Partition:

Note: Partitioning of a volume is not currently supported, but may be in the future.

For Mode Select, this is the logical partition to be changed to, if the CAP bit is on.

For Mode Sense, this is the current logical partition.

4 Write Buffer Full Ratio: X'00' (value not specified)

5 Read Buffer Empty Ratio: X'00' (value not specified)

6-7 Write Delay Time: X'0014' (about 2 sec)

8

Bit	Description
7	DBR (Data Buffer Recovery): B'1'
6	BIS (Block Identifier Supported): B'1'
5	RSmk (Report Setmarks): B'0'
4	AVC (Automatic Velocity Control): B'0'
3-2	SOCF (Stop on Consecutive Filemarks): This is not a changeable field. • B'00' (read ahead to fill buffer, without regard for filemarks)
1	RBO (Recover Buffer Order): • B'0' (FIFO) • B'1' (LIFO) This field is changeable. The default value is B'0' (FIFO).
0	REW (Report Early Warning): B'0'

9 Gap Size: X'00'

10

Bit	Description
7-5	EOD Defined (End Of Data Defined): B'000'
4	EEG (Enable EOD Generation): B'1'
3	SEW (Synchronize at Early-Warning): B'1'
2	SWP (Soft Write Protect): B''
1-0	Reserved

11-13 Buffer Size at Early Warning: X'000000'

14 Select Data Compression Algorithm:

Value	Description
X'00'	No compression used
X'01'	Use default compression algorithm (LZ1)
X'02-FF'	Reserved

This field is changeable. The default value is X'01'.

Note: On a Mode Sense, the value of byte 14 will always match up with what is found on Mode Page X'0F', Byte 2, Bit 7. If this byte alone is updated on a Mode Select, and Mode Page X'0F' is not sent, then Mode Page X'0F', Byte 2, Bit 7 is updated to match what was set in this field. If both Page X'10' and Page X'0F' are sent, then what is in Page X'0F' is used to update both fields and any legal value in byte 14 is ignored.

15

Bit	Description
7-3	Reserved
2	ASOCWP (Associated Write Protect) • B'0': No soft write protect is in effect • B'1': No write type commands will be allowed for the current mount This field is changeable. The default value is B'0'.
1	PERSWP (Persistent Write Protect) • B'0': Persistent Write Protect not in effect • B'1': No write type commands will be allowed on this tape. This field is changeable. The default value is B'0'.
0	PRMWP (Permanent Write Protect) • B'0': No soft write protect is in effect • B'1': No write type commands will ever be allowed for the mounted tape This field is changeable (but cannot be reset). The default value is B'0'. These write protect bits are new to SCSI-3. The identical functions are provided by the write protect bits in vendor unique Mode Page 23. On a Mode Sense, the values in byte 15 will always match up with what is found on vendor unique Mode Page X'23', Byte 10. If this byte alone is updated on a Mode Select, and Mode Page X'23'

is not sent, then Mode Page X'23', Byte 10 is updated to match what was set in this field. If both Page X'10' and Page X'23' are sent, then what is in Page X'10', byte 15 is used to update both fields and any legal value in Mode Page X'23', Byte 10 is ignored.

Mode Page X‘11’: Medium Partition Page(1)

Note: Partitioning of a volume is not currently supported, but may be in the future.

This page is defined as common to all initiators.

This mode page allows the initiator to change the number of partitions on a volume. Two modes are implemented: Select Data Partitions (SDP) and Initiator-Defined Partitions (IDP). The Fixed Data Partition mode (FDP) is not supported.

The partitioning of the mounted volume is not changed until a subsequent Format Medium command is issued while the volume is mounted.

Notes:

1. There is an overhead associated with each additional partition, regardless of the size of the partition, that subtracts from the customer data space on the volume. The larger the number of possible partitions, the more overhead is consumed when the volume is partitioned.
2. A volume with a capacity scaling of less than 100 percent cannot be partitioned using this function. That is, if partitioning is selected, the Capacity Scaling field (byte 12) of Mode Page X'23' is forced to X'00' (100 percent capacity) when the Format Medium command is received.
3. For Mode Select, if this mode page is received with the FDP, SDP, and IDP fields all set to B'0', the mode page is allowed and ignored.
4. For Mode Sense of a cartridge that has never been partitioned (factory default), this mode page indicates SDP mode with one partition.

Mode Page X‘11’ Medium Partition Page(1) for SDP:

Byte **Description**

0

Bit	**Description**
7	PS (Page Save): B'0'
6	Reserved
5-0	Page Code: X'11'

1 Page Length:

The page length depends on the number of partitions on the volume. For one partition (partition 0), Page Length is set to X'08'. For two or more partitions, Page Length is set to X'86'.

2 Maximum Additional Partitions: X'00' or X'3F'

This field specifies the maximum number of additional partitions supported by this drive. It can be thought of as the value N-1 where N is the maximum number of partitions allowed.

If the drive is ready, the value is X'3F'. If the drive is not ready, the value is X'00'.

This field may not be changed.

3 Additional Partitions Defined:

This field specifies the number of additional partitions on the mounted volume (in addition to partition 0). It can be thought of as the value N-1 where N is the total number of partitions.

The values for this field may be X'00, 01, 03, 07, 0F, 17, 1F, 27, 2F, 37, or 3F' for SDP. If the drive is not ready, the value is X'00'.

This is a changeable field and subject to rounding (values are rounded up). This field may not be changed when the drive is not ready.

The partitioning of the mounted volume is not changed until a subsequent Format Medium command is issued while the volume is mounted.

4

Bit	Description
7	FDP (Fixed Data Partitions): B'0'
6	SDP (Select Data Partitions): For Mode Sense, this bit is set to B'1'. For Mode Select, • B'0': All values of this mode page are ignored. • B'1': The drive is to partition according to the Additional Partitions Defined field.
5	IDP (Initiator Defined Partitions): B'0'
4-3	PSUM (Partition Size Unit of Measure): B'10' (Unit of measure is MB)
2	POFM (Partition on Format Medium): B'1' This bit indicates that the Mode Select command will not cause changes to the partition sizes or user data, either recorded or buffered. Actual media partitioning occurs with a subsequent Format Medium command using the mode data for Medium Partition Page (1). Field values specified by a Mode Select command for Medium Partition Page (1) will not be changed by the drive before the media is unloaded or the drive is reset.
1	CLEAR (Partition clearing): B'0'
0	ADDP (Adding Partitions): B'0'

5 Medium Format Recognition: X'03' (Capable of format and partition recognition)

6

Bit	Description
7-4	Reserved
3-0	Partition Units: X'0'

7 Reserved

8-9 or Partition Size Descriptors (2 bytes each):

8-135

Each 2 byte field specifies the size of a partition (in MB) whose partition number is in the range of 0..63, beginning with partition 0. Summing the partition sizes provides a mechanism for an initiator to calculate the volume capacity with Mode Sense in a standard way as opposed to 3590 vendor unique Mode Page X'23'.

For Mode Select, any values for these fields are allowed and ignored for SDP. These fields are updated by the drive when an initiator specifies a new number of partitions.

Note: When more than one partition is defined, the sum of the partition sizes may be less than when only a single partition is defined. Each partition requires a certain amount of overhead space on a volume, which reduces the usable customer data space.

Mode Page X‘18’: Fibre Channel Logical Unit Control

There is one copy of this page for each initiator. This page is defined for Fibre Channel attached devices only.

Byte	Description
0	

Bit	Description
7	PS: 0
6	Reserved
5-0	Page Code: X'18'

1	Page Length: X'06'
2	Reserved
3	

Bit	Description
7-1	Reserved
0	EPDC (Enable Precise Delivery Control)

4-7	Reserved

Mode pages X'01', X'02', X'0A', X'0F',X'10', X'11', X'20', X'21', X'22', X'23', X'24', X'25', and X'3F' (return all pages) are supported by both B-Series Models and E-Series Models. Mode pages X'18' and X'19' are supported only when Fibre Channel is attached. B-Series Models also support Mode pages X'1D', X'1E', and X'1F' on both the Drive and Medium Changer LUNs. E-Series Models support these three Mode Pages only on the Medium Changer LUN.

Mode Page X‘19’: Fibre Channel Port Control

There is one copy of this page per Fibre Channel port. This page is defined for Fibre Channel attached devices only.

Byte **Description**

0

Bit	Description
7	PS: 0
6	Reserved
5-0	Page Code: X'19'

1 Page Length: X'0E'

2 Reserved

3

Bit	Description
7	DTFD (Disable Target Fabric Discovery): 0
6	PLPB (Prevent Loop Port Bypass): 0
5	DDIS (Disable Discovery): 0
4	DLM (Disable Loop Master): 0
3	RHA (Require Hard Address): 0
2	ALWI (Allow Login without Loop Initialization): 0
1	DTIPE (Disable Target Initiated Port Enable): 0
0	DTOLI (Disable Target Originated Loop Initialization): 0

4-5 Reserved

6

Bit	Description
7-3	Reserved
2-0	RR_TOV B'000' - No timer is specified B'001' - Timer is specified in .001 second units B'011' - Timer is specified in .1 second units B'101' - Timer is specified in 10 second units

7 RR_TOV (Resource Recovery Time Out Value)

8

Bit	Description
7-2	Reserved
1-0	Control MCM (Multiple Circuit Mode): B'01'

9-10 Reserved

11 Originator CMRs Per Port: 0

12 Reserved

13 Responder CMRs Per Port: 0

14-15 MCM_TOV (MCM Time Out Value): 0

Mode pages X'01', X'02', X'0A', X'0F',X'10', X'11', X'20', X'21', X'22', X'23', X'24', X'25', and X'3F' (return all pages) are supported by both B-Series Models and E-Series Models. Mode pages X'18' and X'19' are supported only when Fibre Channel is attached. B-Series Models also support Mode pages X'1D', X'1E', and X'1F' on both the Drive and Medium Changer LUNs. E-Series Models support these three Mode Pages only on the Medium Changer LUN.

Mode Page X‘1D’: Element Address Assignment

This page is defined as common for all initiators. This page is a static page, independent of the presence of the 3590 ACF, the current operating definition, or the current ACF mode of operation. Addresses defined here are those which should be used by the Move Medium command.

Byte	Description
0	

Bit	Description
7	PS: B'0'.
6	Reserved
5-0	Page Code: X'1D'

1	Parameter Length: X'12'
2-3	Medium Transport Element Address: X'0000'
4-5	Number of Medium Transport Elements: X'0001'
6-7	First Storage Element Address (magazine cell address): X'0020'
8-9	Number of Storage Elements: X'000A'
10-11	First Import/Export Element Address (the import/export element is often referred to as the “priority cell” or “priority slot”): X'001F'
12-13	Number of Import/Export Elements: X'0001'
14-15	First Data Transfer Element Address (the data transfer element is more commonly known as the drive, the unit with the read/write head): X'0010'
16-17	Number of Data Transfer Elements: X'0001'
18-19	Reserved

Note: The fields in Mode Page X'1D' are not changeable. If a Mode Select command is issued with values other than those returned by a Mode Sense command, the device returns CHECK CONDITION status with associated sense data of 5/2600 (Illegal Request, Invalid Field in Parameter List).

Mode Page X‘1E’: Transport Geometry Parameters

The transport geometry parameters page defines whether each medium transport element is a member of a set of elements that share a common robotics subsystem and whether the element is capable of medium rotation. One transport geometry descriptor is returned for each medium transport element. Because the 3590 ACF has only one medium transport element, only one descriptor is returned.

This page is defined as common to all initiators. This page is a static page, independent of the presence of the 3590 ACF, the current operating definition, or the current ACF mode of operation.

There are no changeable parameters in this mode page.

Byte	Description
0	

Bit	Description
7	PS: B'0'
6	Reserved
5-0	Page Code: X'1E'

1	Page Length: X'02'
2	

Bit	Description
7-1	Reserved
0	Rotate: B'0'

3590 ACF does not support media rotation.

3	Member Number in Transport Element Set: X'00'

Because the 3590 ACF has only one transport element, this byte is set to 0.

Mode Page X‘1F’: Device Capabilities

This page is defined as common for all initiators. This page is a static page, independent of the presence of the 3590 ACF, the current operating definition, or the current ACF mode of operation.

Byte **Description**

0

Bit	Description
7	PS: B'0'
6	Reserved
5-0	Page Code: X'1F'

1 Parameter Length: X'0E'

2 Store XX Field

Bit	Description
7-4	Reserved
3	StorDT (Store in Data Transfer): B'1'
2	StorI/E (Store in Import/Export): B'1'
1	StorST (Store in Storage Element): B'1'
0	StorMT (Store in Medium Transport): B'0'

3 Reserved

4 Medium Transport Capabilities

Bit	Description
7-4	Reserved
3	MT->DT (Can move from an MT element to a DT element): B'0'
2	MT->I/E (Can move from an MT element to an I/E element): B'0'
1	MT->ST (Can move from an MT element to a ST element): B'0'
0	MT->MT (Can move from an MT element to a MT element): B'0'

5 Storage Element Capabilities

Bit	Description
7-4	Reserved
3	ST->DT (Can move from a ST element to a DT element): B'1'
2	ST->I/E (Can move from an ST element to an I/E element): B'1'
1	ST->ST (Can move from a ST element to a ST element): B'1'
0	ST->MT (Can move from an ST element to an MT element): B'0'

6 Import/Export Element Capabilities

Bit	Description
7-4	Reserved
3	I/E->DT (Can move from an I/E element to a DT element): B'1'
2	I/E->I/E (Can move from an I/E element to an I/E element): B'0'
1	I/E->ST (Can move from an I/E element to an ST element): B'1'
0	I/E->MT (Can move from an I/E element to an MT element): B'0'

7 Data Transfer Element Capabilities

Bit	Description
7-4	Reserved
3	DT->DT (Can move from a DT element to a DT element): B'1'
2	DT->I/E (Can move from an DT element to an I/E element): B'1'
1	DT->ST (Can move from a DT element to a ST element): B'1'
0	DT->MT (Can move from a DT element to an MT element): B'0'

8-11 Reserved

12 Medium Transport Element Exchange Capabilities

Bit	Description
7-4	Reserved
3	MT<>DT: B'0'
2	MT<>I/E: B'0'
1	MT<>ST: B'0'
0	MT<>MT: B'0'

13 Storage Element Exchange Capabilities

Bit	Description
7-4	Reserved
3	ST<>DT: B'0'
2	ST<>I/E: B'0'
1	ST<>ST: B'0'
0	ST<>MT: B'0'

14 Import/Export Element Exchange Capabilities

Bit	Description
7-4	Reserved
3	I/E<>DT: B'0'
2	I/E<>I/E: B'0'
1	I/E<>ST: B'0'
0	I/E<>MT: B'0'

15 Data Transport Element Exchange Capabilities

Bit	Description
7-4	Reserved
3	DT<>DT: B'0'
2	DT<>I/E: B'0'
1	DT<>ST: B'0'
0	DT<>MT: B'0'

Note: The fields in Mode Page X'1F' are not changeable. If a Mode Select command is issued with values other than those returned by a Mode Sense command, the device returns CHECK CONDITION status with associated sense data of 5/2600 (Illegal Request, Invalid Field in Parameter List).

Mode Page X‘20’: ACF (Loader) Control

This page is defined as common to all initiators. This page is reported by LUN 0 regardless of the current operating definition.

Page Code 20 is designed to support the ACF.

Byte **Description**

0

Bit	Description
7	PS (Page Save): B'0'
6	Reserved
5-0	Page Code: X'20'

1 Page Length: X'0A'

2 Loader Mode:

Value	Description
X'00'	No Loader or undefined type of loader **Note:** This is the setting for non-ACF models.
X'01'	System Mode Only the operator can cause the ACF to enter System mode. System mode can be selected from the operator panel Set ACF Mode menu. See “System Mode” on page 225 for a full description of System mode.
X'02'	Random or Random 2-LUN Mode (SCSI Medium Changer mode) Only the operator can cause the ACF to enter Random or Random 2-LUN mode. Random or Random 2-LUN mode can be selected from the operator panel Set ACF Mode menu. The magazine must be present and in a locked condition before the command is accepted. Refer to “Random Mode” on page 226 for a full description of Random mode. Refer to “Random 2-LUN Mode (B-Series Models Only)” on page 228 for a full description of Random 2-LUN mode. **Note:** For E-Series Models, only the Random option is available.
X'03'	Manual Mode Only the operator can cause the ACF to enter Manual mode. Manual mode can be selected from the operator panel Set ACF Mode menu. Refer to “Manual Mode” on page 221 for a full description of Manual mode.
X'04'	Accumulate Mode Only the operator can cause the ACF to enter Accumulate mode. It can be selected from the operator panel Set ACF Mode menu. Refer to “Accumulate Mode” on page 222 for a full description of Accumulate mode.
X'05'	Automatic (Sequential) Mode

Only the operator can cause the ACF to enter Automatic mode. It can be selected from the operator panel Set ACF Mode menu.

Refer to “Automatic Mode” on page 223 for a complete description of Automatic mode.

The Loader Mode field is **not** changeable from the SCSI interface. If the mode is changed from the operator panel, all initiators receive a Unit Attention. Any mode set through the operator panel becomes effective immediately and is stored in nonvolatile memory as the default mode for subsequent power-on cycles.

3 Reserved

4 Loader Qualifier

The loader qualifier field allows for variations of operation within a given mode.

Bit	Description
7	Multiple Access: B'0'
6	Priority Cell Enabled: B'1'
5-0	Reserved

5-11 Reserved

Note: The fields in Mode Page X'20' are not changeable from the SCSI interface. If a Mode Select command is issued with values other than those returned by a Mode Sense command, the device returns CHECK CONDITION status with associated sense data of 5/2600 (Illegal Request, Invalid Field in Parameter List).

Mode Page X‘21’: TOD Control

The TOD (Time-of-Day) control is used to provide the device with an estimate of the correct time. The device adds the current TOD clock to every block transferred to media. These time traces can then be used by engineering for analysis of medium at a later time.

The Time-of-Day clock is a binary counter with a 64-bit format: bit 63 being the highest value; bit 0 being the lowest. Bit 12 represents a 1 microsecond clock; that is, the TOD is incremented by 1 in bit position 12, once every microsecond. This gives the TOD clock a cycle time of approximately 143 years. Setting the high order byte to any number greater than X'F0' will result in parameter rounding down to X'F0' with CHECK CONDITION status and associated sense data of 1/3700 (Recovered Error, Rounded Parameter).

The time of day may be set only when the device is in the Not Ready state. If an initiator attempts to set the TOD when the device is Ready, the command is terminated with CHECK CONDITION status and associated sense data of 1/3700 (Recovered Error, Rounded Parameter). Note that this choice is made to avoid failing applications for incorrect attempts at setting the TOD clock. Rounding in this case results in no change.

This page is defined as common to all initiators.

Page Code 21 is designed to provide the time-of-day clock setting to the device for 3590 format data.

Byte **Description**

0

Bit	Description
7	PS (Page Save): B'0'
6	Reserved
5-0	Page Code: X'21'

1 Page Length: X'0A'

2-9 Time of Day

This is a changeable field.

The default time setting at power on is X'0000 0000 0000 0000'. The Time of Day (TOD) clock begins counting relative time from that point.

The TOD clock can be set by any initiator at any time the device is in the Not Ready state. When sensed, the TOD field returns the time of day last set into the device by an initiator. If the TOD field has never been set by an initiator, the TOD field contains X'0000 0000 0000 0000'. A clock value of X'0000 0000 0000 0000' corresponds to a time of January 1, 1900, 0:00 AM, Greenwich Mean Time.

10 Time-of-Day Flags

Bit	Description
7-3	Reserved
2	TOD Reset Valid • B'0': The TOD clock will not be reset. Default value on Mode Sense • B'1': The TOD clock will be reset (valid only on Mode Select)
1	SysSet TOD • B'0': The TOD was not set by an initiator

- B'1': The TOD was set by an initiator

This field is not a changeable field. It describes the state of the TOD counter.

0 Relative TOD

- B'0': The TOD was not set by the device
- B'1': The TOD was set by the device

This field is not a changeable field. It describes the state of the TOD counter.

11 Reserved

Mode Page X‘22’: Language

The Language page is used to provide the initiator with the ability to request a change of the language displayed on the operator panel.

This page is defined as common to all initiators.

Page Code 22 is designed to report or request a change to the language displayed on the operator panel. This page is supported for all models, even for models with no operator panel.

Byte **Description**

0

Bit	Description
7	PS (Page Save): B'0'
6	Reserved
5-0	Page Code: X'22'

1 Page Length: X'02'

2 Present Language

When sensed, this field indicates the current language. The following languages are supported:

Code	Language
X'00'	U.S. English
X'01'	Spanish
X'02'	German
X'(03-FF)'	Reserved

The default setting at power on is the current value in VPD. This field is not directly changeable, although it may be indirectly changed by updating the “Requested Language” field of this mode page or by selecting a different language at the operator panel.

3 Requested Language

The codes described for “Present Language” above apply to the selection of a requested language. This field is changeable. When sensed, this field has the same value as the “Present Language” field. When selected, this field will result in an update to the “Present Language” field.

Mode Page X‘23’: Medium Sense

The Medium Sense page provides information about the state of the medium currently associated with the device, if any.

This page is defined as common to all initiators.

Note: Issuing a Mode Sense for current values before a Mode Select is generally recommended to avoid accidentally attempting to set fields that cannot be changed by the initiator. ***Not all fields in this page can be set by users. All fields other than those explicitly indicated that can be set by users are read-only.***

Byte **Description**

0

Bit	**Description**
7	PS (Page Save): B'0'
6	Reserved
5-0	Page Code: X'23'

1 Page Length: X'22'

2-3 Reserved

4-5 Medium Identifier:

When there is an associated medium, this field contains the medium identifier of the associated medium.

Value	**Description**
X'0000'	No medium present
X'0130'	Medium present is High Performance Cartridge Tape
X'0131'	Medium present is Extended High Performance Cartridge Tape

6 Format Identifier:

When there is an associated medium, this field contains the format identifier of the associated medium.

Value	**Description**
X'00'	No medium present
X'23'	Medium present was last written on a B-Series model (B-Format) and is one of the following: • High Performance Cartridge Tape with 10GB native capacity • Extended High Performance Cartridge Tape with 20GB native capacity
X'24'	Medium present was last written on a E-Series model (E-Format) and is one of the following: • High Performance Cartridge Tape with 20GB native capacity • Extended High Performance Cartridge Tape with 40GB native capacity

Note: B-Series drives can read or write only B-Format density. E-Series drives can read B-Format density and can read or write E-Format density. Any drive can write any tape when at Beginning of Tape. Once the write at BOT is done, the Density Code will change implicitly to the appropriate value.

7-9 Reserved

10 Write Protect Flags

There are two forms of write protect: logical and physical, and three types of logical write protect. Each performs essentially the same function: each protects the customers data from change. Each write protect method performs that function; the only difference is the permanence of the effect (but note the differences with respect to VCR validity for Associated Write Protection).

Bits **Description**

7 Physical Write Protect

This field is also found in “Request Sense - X‘03’” on page 151 (byte 24, bit 1).

This field indicates the state of the physical Write Protect switch located on the cartridge. This switch is controlled by the user. When the switch is set to 1, the entire physical volume is set to the write protected state; when the switch is set to 0, the volume is physically write enabled.

- B'0': The cartridge write protect switch is set to write enabled.
- B'1': The cartridge write protect switch is set to write protected state.

This field is not changeable.

This field may be changed only by physically changing the state of the switch on the cartridge. After the cartridge is loaded into the device, the write protect switch is not available to the user, and, therefore, does not change states while mounted.

6 Associated Write Protect

An OR condition of the three forms of logical write protect may be found in “Request Sense - X‘03’” on page 151 (byte 24, bit 0).

This field allows an initiator to set the logical volume to the Associated Write Protected state. Associated Write Protect protects a volume only while the logical volume is associated with (mounted on) the device.

For a Mode Select command, this field has the following meaning:

- B'0': Do not change the Associated Write Protect state.
- B'1': Set this logical volume to the Associated Write Protect state.

For a Mode Sense command, this field responds with a B'1' only if the logical volume is set to Associated Write Protect, or it responds with a B'0'.

The logical volume can be set to Associated Write Protect *at any time*. The medium need *not* be positioned to Beginning of Partition (BOP).

When the initiator accepts the GOOD status from the Mode Select command, the logical volume is write protected. Buffered write data is not necessarily transferred to the medium prior to the completion of the Mode Select command. It is transferred at such time as it would have been had no further writes been issued (in any case prior to cartridge unload).

The Associated Write Protect state remains only as long as the medium is associated with (mounted on) the device. Both Unload and Power Off return the logical volume to the default state of write enabled. The initiator can also write enable the logical volume by issuing the Mode Select command with the Reset Associated Write Protect field set to B'1'.

While in the Associated Write Protect state, any attempt to repartition, reformat, or write results in CHECK CONDITION status with associated sense data of 7/2700 (Data Protect, Write Protected).

Note: For models with an operator panel, the write protect icon will appear on the status screen when the medium is physically or logically write protected. Except for the time span covered by cartridge loading and cartridge unloading, the icon will remain on until the initiator requests the write protection status to change or unload or power-off occurs, which reset the status by default. During load and unload the icon will revert to the unprotected indicator. This is due to updates to the tape VCR region, which requires writing. Unlike Physical Write Protection, Persistent Write Protection, or Permanent Write Protection, the VCR is subject to change when under Associated Write Protection. This means that unexpected power-offs during the load or unload process while Associated Write Protection is set may result in the VCR being in an invalid state, just as is possible when no write protection is active. Subsequent locate and space operations to the volume will operate at low speed until new records are written and the VCR is rebuilt.

5 Reset Associated Write Protect

A 1 in this field causes the Associated Write Protect state to be reset; that is, to change the state of the logical volume from write protected to write enabled. After being reset, the logical volume again accepts write commands.

For a Mode Select command, this field has the following meaning:
- B'0': Do not change the Associated Write Protect state.
- B'1': Reset the Associated Write Protect state for this logical volume.

For a Mode Sense command, this field is B'0'.

When the device successfully executes a Reset Associated Write Protect, the device immediately resets the write protected state to the write enabled state and allows write commands from that point.

4 Persistent Write Protect

An OR condition of the three forms of logical write protect may be found in “Request Sense - X‘03’” on page 151 (byte 24, bit 0).

This field allows an initiator to set the logical volume to the write protected state. Unlike the Associated Write Protect, Persistent Write Protect ‘persists’ across mount cycles because the state is written in the VCR of the volume.

For a Mode Select command, this field has the following meaning:

- B'0': Do not change the Persistent Write Protect state.
- B'1': Set this logical volume to the Persistent Write Protect state.

For a Mode Sense command, this field responds with a B'1' only if the logical volume is set to Persistent Write Protect; otherwise, it responds with a B'0'.

The volume can be set to Persistent Write Protect only when the medium is positioned to Beginning of Partition 0 (BOP 0). The device writes the Persistent Write Protect field in the VCR and presents status to the initiator. If the command fails, persistent write protection cannot be guaranteed.

Unlike Permanent Write Protect (see below), the volume may be write enabled by issuing a Mode Select with the Reset Persistent Write Protect field set to B'1'. Similar to Permanent Write Protect, if a partition is set to Persistent Write Protect, the physical volume may not be repartitioned unless all partitions on the volume are write enabled. Any attempt to repartition, reformat, or write results in CHECK CONDITION status with associated sense data of 7/2700 (Data Protect, Write Protected).

3 Reset Persistent Write Protect:

A 1 in this field causes the Persistent Write Protect field to be reset; that is, to change the state of the logical volume from write protected to write enabled. After being reset, the logical volume again accepts write commands.

For a Mode Select command, this field has the following meaning:
- B'0': Do not change the Persistent Write Protect state.
- B'1': Reset the Persistent Write Protect state for this logical volume.

For a Mode Sense command, this field is B'0'.

The device must be at BOP 0 to accept Reset Persistent Write Protect.

2-1 Reserved

0 Permanent Write Protect

An OR condition of the three forms of logical write protect may be found in “Request Sense - X‘03’” on page 151 (byte 24, bit 0).

This field allows an initiator to set the logical volume to a permanently write protected state. Similar to the Persistent Write Protect, Permanent Write Protect ‘persists’ across mount cycle because the state is written in the VCR of the physical volume. Unlike Persistent Write Protect, *Permanent Write Protect can never be reset except by degaussing*.

For a Mode Select command, this field has the following meaning:
- B'0': Do not change the Permanent Write Protect state.
- B'1': Set this logical volume to the Permanent Write Protect state. After being set, *THIS LOGICAL VOLUME CAN NEVER BE WRITTEN ON AGAIN!*

Notes:

1. Only if the physical medium is completely degaussed and reformatted can the writing again be done.
2. The Format Medium command is not currently supported but may be in the future.

For a Mode Sense command, this field responds with a B'1' only if the logical volume is set to the Permanent Write Protect state; otherwise, it responds with a B'0'.

The volume can be set to the Permanent Write Protect state only when the medium is positioned to Beginning of Partition 0 (BOP 0). The device writes the Permanent Write Protect field in the VCR and presents status to the initiator. Any attempt to repartition, reformat, or write results in CHECK CONDITION status with associated sense data of 7/2700 (Data Protect, Write Protected).

11 Capacity Scaling Control

Bits	Description
7-1	Reserved
0	CapScalV (Capacity Scaling Valid) • B'0': Indicates that the device should not scale the medium in accordance with the value in the Capacity Scaling field. • B'1': Indicates that the device should scale the medium in accordance with the value in the Capacity Scaling field.

This field is changeable. The default value is B'0'. For Mode Sense commands, this field is B'0'.

Scaling of the capacity is accepted only at Beginning of Partition 0 (BOP 0). **A valid Capacity Scaling request causes all data on the entire physical volume to be lost.** If this command is received at other than BOP 0, the command is presented CHECK CONDITION status with associated sense data of 5/2600 (Illegal Request, Invalid Field in Parameter List).

12 Capacity Scaling

This field allows an initiator to **logically change the size** of partition 0. One effect is faster access to data at the expense of data capacity. This byte indicates or sets the currently formatted medium capacity in relationship to the maximum medium capacity. Formatted medium capacity in this context refers to the amount of data that can be potentially written on the medium, independently of the amount that is currently written. The capacity is reduced to a value of n/256*100 percent of this maximum capacity where n is the value in the Capacity Scaling field and ranges between 1 and 256 (X'01 - FF, 00'). (The value X'00' represents 256, or 100% of capacity.) For example, a Capacity Scaling value of 128 (X'80') reduces the capacity of a single partition volume to 50% of its maximum value, but also reduces the average access time to any given data.

This field is changeable. The default value is X'00'. This medium is changed to the percent indicated in this field only if the CapScalV bit is also set to B'1'.

Only certain values are supported: X'00', X'C0', X'80', and X'40', all other values are rounded up to the next highest value, with all values between X'C1-FF' being rounded ‘up’ to X'00', which represents 100%. If a value is rounded, the device responds to the Mode Select command with CHECK

CONDITION status and associated sense data of 1/3700 (Recovered Error, Rounded Parameter). The device responds to the values in the Capacity Scaling field as follows:

- X'C1-FF,00': 100% Capacity
- X'81-C0': 75% Capacity
- X'41-80': 50% Capacity
- X'01-40': 25% Capacity

This command is accepted only at Beginning of Partition 0 (BOP 0). **A valid Capacity Scaling command causes all data on the entire physical volume to be lost and only partition 0 to remain at some size.** If this command is received at other than BOP 0, the command is presented CHECK CONDITION status with associated sense data of 5/2600 (Illegal Request, Invalid Field in Parameter List).

Mode Sense values returned are X'00', X'C0', X'80', or X'40', corresponding to 100% of maximum capacity, 75% of maximum capacity, 50% of maximum capacity, or 25% of maximum capacity, respectively.

13-16 Medium Capacity

This field specifies the nominal capacity, in kilobytes, of the program accessible portion of the medium indicated by the Medium Identifier in bytes 4-5. If capacity scaling is in effect, this field reflects the capacity after scaling. If the medium is currently partitioned, the nominal capacity of the medium is the sum of the nominal capacity of all partitions. The value in the field multiplied by 1024 yields the approximate capacity in bytes. The field is set to 0 if the capacity is unknown. ***This field is not changeable.*** It is for reporting only.

17 Partition Number

Note: Partitioning of a volume is not currently supported, but may be in the future.

This field specifies the partition number of the currently active partition. The field is set to X'00' if there is only one partition on the medium or if the partition number is unknown. This field cannot be set by a user but reflects changes effected by “Mode Page X‘10’: Device Configuration” on page 98.

See also “Locate -X‘2B’” on page 28 for changing the active partition and “Mode Page X‘10’: Device Configuration” on page 98 for creating partitions.

18-19 Reserved

20 Test Flags

Bit	Description
7-1	Reserved-Vendor-Unique
0	Edge Track • B'0': Disable edge track write mode. • B'1': Activate edge track write mode. This field invokes a mode used for Edge Track testing when the device is being used as a medium tester. This field can **only** be used when the device is being used as a medium tester. If the initiator sets Edge Track and the device is in Tester Mode and the medium is at BOP 0, the device writes on one outside track

while the medium is moving towards EOT, and writes on the other outside track while the medium is moving toward BOP 0.

This field is changeable. The default value is B'0', but this field may only be set to B'1' when (1) the device is previously placed in Tester Mode (a mode that can be set at installation time only) and (2) the medium is at BOP 0.

If the device is not in Tester Mode and an initiator attempts to write this field, CHECK CONDITION status is presented with associated sense data of 5/2600 (Illegal Request, Invalid Field in Parameter List).

If an initiator attempts to write this field at other than BOP 0, the command is presented CHECK CONDITION status with associated sense data of 5/2600 (Illegal Request, Invalid Field in Parameter List).

21 Internal-VOLID Flags

Bits	Description
7	Internal-VOLID Valid • B'0': Indicates that the fields are not valid. • B'1': Indicates that the internal volume-identifier field and the remainder of the internal-VOLID flags field are valid.
6	DBM Valid • B'0': Indicates that the Device Block Map is not valid. • B'1': Indicates that the Device Block Map is valid.
5-3	Reserved
2-0	Internal-VOLID Information Source

Value	Description
0	Internal-VOLID from external source, that is, a library manager.
1	Internal VOLID from medium, namely the VOL1 record.
2-7	Reserved

22-27 Internal-Volume Identifier

If available, this field contains the volume identifier, which is recorded on the medium. The field is left-justified and padded with X'20' (ASCII blanks). If the Volume Identifier is not valid, it is set to X'0000 0000 0000'.

28-31 Partition Capacity

Note: Partitioning of a volume is not currently supported, but may be in the future.

This field specifies the nominal capacity, in kilobytes, of the program accessible portion of the currently active partition. The value in the field multiplied by 1024 yields the number of bytes in the partition. The field is set to 0 if the capacity is unknown. ***This field is not changeable but does reflect changes by other activity.*** It is for reporting only.

32-35 Kilobytes Traversed

This field specifies the current position on the tape measured in kilobytes (1024 bytes) traversed (user data only). The value at the logical end of tape should equal the nominal capacity of the tape. All values are rounded down to the nearest kilobyte.

Mode Page X‘24’: Initiator-Specific Extensions

The Initiator-Specific Extensions page provides controls that allow selective use of CRC protection and permit program control of key synchronous data transfer parameters.

There is one copy of this page for each initiator.

Byte **Description**

0

Bit	Description
7	PS (Page Save): B'0'
6	Reserved
5-0	Page Code: X'24'

1 Page Length: X'16'

2 CRC Target Support

This field cannot be changed by the initiator.

Bits **Description**

7
- B'0': IEEE CRC checking across interface is not supported
- B'1': IEEE CRC checking across interface is supported

6
- B'0': 3590-specific CRC checking across interface is not supported
- B'1': 3590-specific CRC checking across interface is supported

5-0 Reserved

3 CRC Target Enablement

This field can be changed by the initiator.

Value	Description
X'00'	CRC checking across interface disabled (default setting)
X'01'	IEEE CRC checking enabled across interface (not supported currently)
X'02'	3590 CRC checking enabled across interface

4 CRC (1) Placement and Length

This field can be changed by the initiator. Only 4 byte appended CRC is currently supported.

Bits **Description**

7-6 CRC Placement

Value	Description
B'00'	CRC appended to data
B'01'	CRC prefixed to data

5-0 CRC Length (0-64 bytes)

5 CRC (1) Scope

Bits	Description
7	Read data checked: B'1'
6	Write data checked: B'1'
5	Parameter read data checked: B'0'
4	Parameter write data checked: B'0'
3	CDB checked: B'0'
2	Reserved-Vendor-Unique

1-0 Reserved

6 Other CRC (1) Characteristics

Bits	Description
7	CDB transfer length includes CRC length if B'1' (not changeable).
6	Big Endian if B'1'. Little Endian if B'0' (not changeable).
5	• B'0': Check One on Read CRC Miscompare • B'1': Check Condition on Read CRC Miscompare This is a changeable field. The default value is B'1'.
4	• B'0': Check One on Write CRC Miscompare • B'1': Check Condition on Write CRC Miscompare This is a changeable field. The default value is B'1'.
3	• B'0': Deferred Check Condition or Check One on Write CRC Miscompare • B'1': Immediate Check Condition on Write CRC Miscompare This is a changeable field. The default value is B'1'.
2-0	Reserved

7-12 Reserved

13 Transfer Period for SDTR Message expressed as a multiple of 4ns. Set to X'FF' for target default behavior (will try to match initiator). Half speed operation is at 200ns (field=50). Does not persist across resets.

14 REQ/ACK Offset for SDTR Message. Set to X'FF' for target default behavior (will try to match initiator). Does not persist across resets.

15 Buffer Association Enablement (DDR Support). This is persistent across SCSI bus resets and bus device resets.

Bits	Description
7	• B'0': Manual Unload Association Disabled • B'1': Manual Unload Association Enabled
6	• B'0': Manual Rewind Association Disabled • B'1': Manual Rewind Association Enabled
5	• B'0': Association on Unload With Write Error Disabled • B'1': Association on Unload With Write Error Enabled
4-0	Reserved

16-23 Reserved

Mode Page X‘25’: Read/Write Control

This page is defined as common to all initiators.

Byte **Description**

0

Bit	Description
7	PS (Page Save): B'0'
6	Reserved
5-0	Page Code: X'25'

1 Page Length: X'1E'

2

Bit	Description
7-3	Reserved
2	Ignore Sequence Checks on Locate command • B'0': Do not ignore sequence checks • B'1': Ignore sequence checks This is a changeable field. The default value is B'0'.
1	Ignore Sequence Checks on Space command for blocks • B'0': Do not ignore sequence checks • B'1': Ignore sequence checks This is a changeable field. The default value is B'0'.
0	Ignore Sequence Checks on Space command for filemarks • B'0': Do not ignore sequence checks • B'1': Ignore sequence checks This is a changeable field. The default value is B'0'.

3

Bit	Description
7-5	Reserved
4-3	Reserved Vendor-Unique
2	Ignore Data Checks on Locate command • B'0': Do not ignore data checks • B'1': Ignore data checks This is a changeable field. The default value is B'1'.
1	Ignore Data Checks on Space command for blocks • B'0': Do not ignore data checks • B'1': Ignore data checks This is a changeable field. The default value is B'1'.
0	Ignore Data Checks on Space command for filemarks • B'0': Do not ignore data checks • B'1': Ignore data checks This is a changeable field. The default value is B'1'.

4-5 Reserved

6-7 Logical End of Partition — Early Warning (LEOP-EW)

This field provides a vehicle for the initiator to enable an early warning indication of the approach of the Logical End of Partition (LEOP). This warning may be used by the initiator to ensure it has sufficient remaining space on the current tape partition to commit all of its internal write buffers. The early warning is provided in the form of a deferred CHECK

CONDITION status with associated sense data of 6/0002 (Unit Attention, End-of-Partition/Medium Detected). This CHECK CONDITION status is returned when the first device block is committed to the medium which comes within the specified number of megabytes of the LEOP. The normal initiator response may be to stop further writes and flush all initiator buffered data to the drive.

This field is changeable and is specified in megabytes. The default value is X'0000'. A value of X'0000' results in no warning being given. Any value from X'0001' to X'000B' results in a warning 11 megabytes prior to the LEOP. Any other value specifies the number of megabytes prior to the LEOP that the warning will occur. The device makes a worst case compression assumption.

8

Bit	Description
7-1	Reserved
0	Report VCR Errors • B'0': If the Mode Page X'01' PER bit is set to B'0', do not report VCR errors. • B'1': Report CHECK CONDITION status and deferred sense data of 1/0000 (Recovered Error, No Additional Sense Information) for permanent read/write VCR errors including Device Block Map (DBM) invalid. This field is changeable. The default value is B'0'.

9-31 Reserved

Move Medium -X‘A5’

The Move Medium Command is supported by LUN 0 of the drive only on B-Series models and then only when operating as an Attached Medium Changer.

The Move Medium command supported by the drive (LUN 0) is the same as the Move Medium command supported by the ACF (LUN1). “Move Medium -X‘A5’” on page 202 for a description of the Move Medium Command.

Persistent Reserve In - X‘5E’

Persistent Reserve In command is supported by the Magstar drive. Table 28 shows the command format.

Table 28. Persistent Reserve In Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Opcode: X'5E'							
1	Reserved			Service Action				
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Allocation Length							
7								
8								
9	Control							

The following Magstar-specific parameters apply:

- Service Action:
  - B'00000': Reads all registered Reservation Keys
  - B'00001': Reads all current persistent reservations
- Allocation Length: The maximum number of bytes to be transferred.

The Persistent Reserve In parameter data for Read Keys is defined below:

Byte	Description
0-3	Generation: Counter for Persistent Reserve Out Command requests
4-7	Additional length: A count of the number of bytes in the Reservation key list
8-15	First Reservation Key
16-n	Additional Reservation keys: a maximum of 1 reservation key per initiator is supported

The Persistent Reserve In parameter data for Read Reservations is defined below:

Byte	Description
0-3	Generation: Counter for Persistent Reserve Out Command requests
4-7	Additional length: A count of the number of bytes in the Reservation key list
8-n	Reservation descriptors: (defined below)

The Persistent Reserve In Read Reservations Descriptor is defined below:

Byte	Description
0-7	Reservation Key
8-11	Scope-specific address: 0
12	Reserved

13

Bit	Description
7-4	Scope: persistent reservation applies to the entire logical unit: X'0'
4-0	Type:
	X'3': Exclusive Access
	X'6': Exclusive Access, Registrants only

14-15 Extent Length: 0

Persistent Reserve Out - X‘5F’

Persistent Reserve Out command is supported by the Magstar drive. Table 29 shows the command format.

Table 29. Persistent Reserve Out Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Opcode: X'5F'							
1	Reserved			Service Action				
2	Scope				Type			
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Parameter list length							
8								
9	Control							

The following Magstar-specific parameters apply:

- Service Action:
  - B'00000': Register a reservation key with the device server
  - B'00001': Create a persistent reservation using a reservation key
  - B'00002': Release a persistent reservation
  - B'00003': Clear all reservation keys and all persistent reservations
  - B'00004': Preempt persistent reservations from another initiator
  - B'00005': Preempt persistent reservations from another Initiator and clear the task set for the preempted initiator
- Scope: 0

Type:

X'3': Exclusive Access

X'6': Exclusive Access, Registrants only

- Parameter list length: x0018

The Persistent Reserve Out parameter list is defined below:

Byte	Description
0-7	Reservation key
8-15	Service action Reservation key
16-19	Scope-specific address: 0
20	

Byte	Description
7-1	Reserved
0	APTPL: Activat Persist Through Power Loss: 0

21	Reserved
22-23	Obselete: 0

Prevent Allow Medium Removal - X‘1E’

The Prevent Allow Medium Removal command is supported by the 3590 drive only for the ‘Prevent Cartridge Removal’ option. Table 30 shows the command format.

Table 30. Prevent Allow Medium Removal Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1E')							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved						Prevent	
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- The Prevent field values follow:

  Value **Description**
  B'00' Allow Cartridge Removal
  B'01' Prevent Cartridge Removal
  B'10' Not Supported
  B'11' Not Supported

- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

The 3590 drive supports Prevent Cartridge Removal by removing the Unload option from the operator panel menu. Cartridge removal is enabled again when the initiator issues the Prevent Allow Medium Removal command, this time with the Prevent field set to B'00' (Allow Cartridge Removal). A reset (bus device reset, reset message, or power on reset) also restores the 3590 drive to the allow removal state. In the case of the bus device reset or the reset message, the reset restores the allow state only if the reset occurs on the same port that originally set Prevent.

Read - X‘08’

The Read command is supported by the 3590 drive. Table 31 shows the command format.

Table 31. Read Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'08')							
1	Logical Unit Number			Reserved			SILI	Fixed
2	Transfer Length							
3								
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- SILI (Suppress Incorrect Length Indicator) (per SCSI-2 standard).
- Fixed:
  - B'0': Variable length blocks are supported
  - B'1': Fixed length blocks are supported
- Transfer Length: value from X'000000' to X'FFFFFF'. Although the maximum block size for this tape drive is X'200000' (2,097,152 bytes), any transfer length is accepted and the underlength condition rules are applied for transfer requests bigger than the actual block size. A transfer Length of X'000000' indicates that no bytes/blocks are transferred. This condition is not considered an error and the logical position is not changed.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

For further explanation, see “Data Transfer, Block Limits, and Fixed Block Option” on page 241.

A successful Read command with a Fixed bit of 1 transfers the requested Transfer Length, times the current block length in bytes to the initiator. A successful Read command with a Fixed bit of 0 transfers the requested Transfer Length in bytes to the initiator. Upon completion, the logical position is after the last block transferred (end-of-partition side).

If SILI bit is B'1' and the Fixed bit is B'0', the target performs one of the following actions:

1. Reports CHECK CONDITION status for an incorrect block length condition only if the overlength condition exists (see SCSI section 10.4) and the Block Length field in the mode parameter block descriptor is nonzero (see SCSI section 8.3.3). The associated sense data is 0/0000 (Incorrect Length, No Sense Data).
2. Does not report CHECK CONDITION status if the only error is the underlength condition (see SCSI-2 section 10.4), or if the only error is the overlength condition and Block Length field of the mode parameters block descriptor is B'0'. (See note 1 on page 132.)

If the SILI bit is B'1' and the Fixed bit is B'1', the target terminates the command with CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

If the SILI bit is B'0' and an incorrect length block is read, CHECK CONDITION status is returned and the ILI and valid bits are set to B'1' in the sense data. Upon termination, the logical position is after the incorrect length block (end-of-partition side). If the Fixed bit is 1, the information field is set to the requested Transfer Length, minus the actual number of blocks read (not including the incorrect length block).

If the Fixed bit is B'0', the information field is set to the requested Transfer Length, minus the actual block length in two's complement format.

If the logical unit encounters a filemark during a Read command, CHECK CONDITION status is returned and the filemark and valid bits are set to B'1' in the sense data. The associated sense data is set to 0/0001 (No Sense, Filemark Detected). Upon termination, the logical position is after the filemark (end-of-partition side). If the Fixed bit is B'1', the information field is set to the requested Transfer Length, minus the actual number of blocks read (not including the filemark). If the Fixed bit is B'0', the information field is set to the requested Transfer Length.

If the logical unit encounters end-of-medium during a Read command, CHECK CONDITION status is returned and the EOM and valid bits are set to B'1' in the sense data. Associated sense data is set to 3/0002 (Medium Error, End of Medium).

If the logical unit encounters early warning and the REW bit is set to 1 in the device configuration page, CHECK CONDITION status is returned and the EOM and valid bits are set to B'1' in the sense data. Associated sense data is set to D/0002 (Overflow, End-of-Partition/Medium Detected). If the Fixed bit is B'1', the information field is set to the requested Transfer Length, minus the actual number of blocks transferred. If the Fixed bit is B'0', the information field is set to the requested Transfer Length.

If the drive encounters End-of-Data (EOD) while executing this command, the command is terminated at the EOD position and CHECK CONDITION status is returned with associated sense data of 8/0005 (Blank Check, End-of-Data Detected). If the next motion command is another request to move forward (beyond EOD), the drive accepts the command and attempts to position beyond EOD in order to allow recovery of old data.

B-Series models cannot read an E-Format tape. If such an attempt is made, CHECK CONDITION status is returned and Associated sense data is set to 3/3002 (Medium Error, Cannot Read Medium - Incompatible Format).

Notes:

1. Because the residue information normally provided in the information field of the sense data may not be available when the SILI bit is set, use other methods to determine the actual block length (for example, including length information in the data block).
2. In the case of the Fixed bit of 1 with an overlength condition, only the position of the incorrect-length logical block can be determined from the sense data. The actual length of the incorrect block is not reported. Other means may be used to determine the actual length (for example, backspace and read it again with Fixed bit set to B'0').

Read Block Limits - X‘05’

The Read Block Limits command is supported by the 3590 drive. Table 32 shows the command format.

Table 32. Read Block Limits Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'05')							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply to the Read Block Limits data:

Byte	Description
0	Reserved
1-3	Maximum Block Length Limit: X'200000' (2,097,152 bytes)
4-5	Minimum Block Length Limit: X'0001' (1 byte)

See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Any block length in the range of 1 to 2,097,152 is supported.

For further explanation, see “Data Transfer, Block Limits, and Fixed Block Option” on page 241.

Read Buffer - X‘3C’

The Read Buffer command is supported by the 3590 drive. Table 33 shows the command format.

Table 33. Read Buffer Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'3C')							
1	Logical Unit Number			Reserved		Mode		
2	Buffer ID							
3	Buffer Offset							
4								
5								
6	Allocation Length							
7								
8								
9	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- Mode: B'001' or B'011'
  - B'001': Vendor Specific mode (returns data contained in the buffer specified by Buffer ID)
  - B'011': Descriptor mode (returns the offset boundary and buffer size in bytes, for the buffer specified in Buffer ID)
- Buffer ID: The buffers supported in the 3590 drive are described in Table 34 on page 135.
- Buffer Offset: In mode B'001', the starting address in the buffer to be read. For mode B'011', this field must be X'000000'.
- Allocation Length: The maximum number of bytes to be transferred.

  The device transfers the number of bytes specified in the Allocation Length field or the number of bytes in the header and buffer being read, whichever is less. This is not an error.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Each buffer image has its own unique format, describing where certain key data may be found. Certain buffers contain embedded data in the buffer image describing the length of the total buffer image, and a CRC field that checks the total buffer image. Uploading the microcode buffer is one such example.

“Magstar Drive Buffers” on page 135 lists the accessible buffers.

Magstar Drive Buffers

Table 34 lists the Magstar drive buffers and their IDs:

Table 34. Magstar Drive Buffers

Buffer	ID	Offset Boundary
Dump and Error Data (Read Only)	X'00'	4
Microcode (Write Only)	X'00'or X'01'	4
Vital Product Data (DRAM)	X'07'	4
Vital Product Data (EEProm)	X'08'	4
Dump Data 2	X'09'	4
Test Buffer	X'0A'	4
Drive Serial Number	X'0F'	4

Each buffer is described in the following list, ordered by buffer ID.

Buffer ID
Buffer

X'00' Dump and Error Data (Read Only)

This buffer is read-only and supports Read Buffer modes 1 and 3. In these modes, the Buffer Offset field provides an offset into the buffer. The Allocation Length specifies the maximum number of bytes to be read from the buffer, starting at the offset specified by the Buffer Offset field. For this buffer, the Buffer Offset must be on a 16-byte boundary. If the Buffer Offset is not on a 16-byte boundary, the device returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

If an initiator attempts to issue a Write Buffer command to this buffer, the device returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

X'07' Vital Product Data (DRAM)

This buffer is read-only and supports Read Buffer modes 1 and 3.

In Read Buffer mode 1, the Buffer Offset field provides an offset into the buffer, and must be on a 16-byte boundary. If the Buffer Offset exceeds the size of the buffer or is otherwise incorrect, the device returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

The Allocation Length field specifies the maximum number of bytes to be read from the buffer, starting at the offset specified by the Buffer Offset field.

X'08' Vital Product Data (EEPROM)

This buffer is read only and supports Read Buffer modes 1 and 3. In Read Buffer mode 1, the Buffer Offset field provides an offset into the buffer. The Allocation Length specifies the maximum number of bytes to be read from the buffer, starting at the offset specified by the Buffer Offset field. For this buffer, the Buffer Offset must be on a 16-byte boundary. If the Buffer Offset is not on a 16-byte boundary, the device returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

If an initiator attempts to issue a Write Buffer command to this buffer, the device returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

X'09' Dump Data 2

This buffer is read only and supports Read Buffer modes 1 and 3. In Read Buffer mode 1, the Buffer Offset field provides an offset into the buffer. The Allocation Length specifies the maximum number of bytes to be read from the buffer, starting at the offset specified by the Buffer Offset field. For this buffer, the Buffer Offset must be on a 16-byte boundary. If the Buffer Offset is not on a 16-byte boundary, the device returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

If an initiator attempts to issue a Write Buffer command to this buffer, the device returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

X'0A' Test Buffer

This buffer may be written and supports Read Buffer modes 1 and 3. In Read Buffer mode 1, the Buffer Offset field provides an offset into the buffer. The Allocation/Parameter List Length specifies the maximum number of bytes to be read from/written to the buffer, starting at the offset specified by the Buffer Offset field. For this buffer, the Buffer Offset must be on a 16-byte boundary. If the Buffer Offset is not on a 16-byte boundary, the device returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

X'0F' Drive Serial Number with Checksum

This buffer is write only and supports Write Buffer Mode 1 with a Buffer Offset of 0 only. The Parameter List Length field must be set to 13. The first 12 bytes of parameter data are the new serial number and the last byte is a checksum of the first 12 bytes. The drive serial number may be read at bytes 38-49 of standard Inquiry data.

If an initiator attempts to issue a Read Buffer command to this buffer, the device returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

Read Element Status - X‘B8’

The Read Element Status Command is supported by LUN 0 of the drive only on B-Series models and then only when operating as an Attached Medium Changer.

The Read Element Status command supported by the drive (LUN 0) is the same as the Read Element Status command supported by the ACF (LUN1).

“Read Element Status - X‘B8’” on page 204 for a description of the Read Element Status Command.

Read Position - X‘34’

The Read Position command is supported by the 3590 drive. Table 35 shows the command format.

Table 35. Read Position Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'34')							
1	Logical Unit Number		Reserved			TCLP	LONG	BT
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Reserved							
8	Reserved							
9	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- BT (Block address Type): B'0'
- LONG: B'0' or B'1'
- TCLP (Total Current Logical Position): B'0' or B'1'

  The LONG and TCLP fields must be equal. If they are not, the device returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

The Read Position data format when TCLP = B'0' is defined below:

Byte **Description**

0

Bit **Description**

7 BOP (Beginning of Partition):

Note: Partitioning of a volume is not currently supported, but may be in the future.

- B'0': indicates that the current logical position is not at the
- B'1': indicates the device is at the

6 EOP (End of Partition)

Note: Partitioning of a volume is not currently supported, but may be in the future.

- B'0': indicates that the device is not between and
- B'1': indicates the device is positioned between and in the current partition.

5 BCU (Block Count Unknown)

- B'0' indicates that the block count is known
- B'1' indicates that the block count is unknown

4 BYCU (Byte Count Unknown)

- B'0' indicates that the block count is known
- B'1' indicates that the block count is unknown

3 Reserved

2 BPU (Block Position Unknown)

- B'0' indicates that the block position is known
- B'1' indicates that the block position is unknown

1 PERR (Position Error): B'0'

0 Reserved

1 Partition Number:

Note: Partitioning of a volume is not currently supported, but may be in the future.

Reports the partition number for the current logical position. When the medium has only one partition, this field is set to 0.

2-3 Reserved

4-7 First Block Location:

Specifies the block address associated with the current logical position. The value indicates the block address of the next data block to be transferred between the initiator and the target if a Read or Write command is issued, in the range X'0000 0000' to X'FFFF FFFF'.

8-11 Last Block Location:

After a write command, this field specifies the block address associated with the next data block to be transferred from the buffer to the medium. After a read command, this field specifies the block address associated with the last (most recent) data block to be transferred from the medium to the buffer. For any case where the buffer no longer contains a whole block of data or is empty, the value reported for the Last Block Location is equal to the value reported for the First Block Location, in the range X'0000 0000' to X'FFFF FFFF'.

12 Reserved

13-15 Number of Write Blocks in Buffer:

The number of data blocks in the buffer that have not been written to the medium. (This value is zero if the device is reading rather than writing.)

16-19 Number of Write Bytes in Buffer

The total number of data bytes (before compaction) in the buffer that have not been written to the medium.

The Read Position data format when TCLP = B'1' is defined below:

Byte **Description**

0

Bit **Description**

7 BOP (Beginning of Partition):

Note: Partitioning of a volume is not currently supported, but may be in the future.

- B'0': indicates that the current logical position is not at the
- B'1': indicates the device is at the

6 EOP (End of Partition)

Note: Partitioning of a volume is not currently supported, but may be in the future.

- B'0': indicates that the device is not between and
- B'1': indicates the device is positioned between and in the current partition.

5-4 Reserved

3 MPU (Mark Position Unknown)

- B'0' indicates that the current logical block position is known
- B'1' indicates that the current logical block position is unknown

2 BPU (Block Position Unknown)

- B'0' indicates that the block position is known
- B'1' indicates that the block position is unknown

1 Reserved

1 Reserved

2 Reserved

3 Reserved

4-7 Partition Number:

Note: Partitioning of a volume is not currently supported, but may be in the future.

Reports the partition number for the current logical position. When the medium has only one partition, this field is set to 0.

8-15 First Block Location:

Specifies the block address associated with the current logical position. The value indicates the block address of the next data block to be transferred between the initiator and the target if a Read or Write command is issued, in the range X'0000 0000' to X'FFFF FFFF'.

16-23 File Number

Specifies the number of filemarks between Beginning of Partition and the current logical position.

Note: There are many non-error situations where the file number is unknown. Because of this, the Mark Position Unknown often is set to TRUE and the File Number field is zero.

24-31 Set Number

Current Set Number: B'0'

Read Reverse - X‘0F’

The Read Reverse command is supported by the 3590 drive. Table 36 shows the command format.

Table 36. Read Reverse Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'0F')							
1	Logical Unit Number			Reserved		Byte Order	SILI	Fixed
2	Transfer Length							
3								
4								
5	Control							

The following 3590-specific parameters apply:

- Byte Order field: B'1'

  This field defines the order in which bytes are transferred to the initiator.

  Byte Order to the initiator is in the logical forward direction (first byte written is transferred to the initiator before the last byte written).

  Note: The Byte Order field is not specified in the *American National Standard Institute Small Computer System Interface X3T9.2/86-109 Revision 10h X3T39/89-042* standard. In that document this bit is Reserved and is a B'0'. The current product does not support reversed byte order and the bit is required to be set to B'1'. An attempt to set this bit to B'0' results in a check condition with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB). Nevertheless, as specified in the standard, the ending position of the medium is before the last block transferred.
- SILI (Suppress Incorrect Length Indicator): This bit is defined the same as for the Read command.
- Fixed: This bit is defined the same as for the Read command.
  - B'0': Variable length blocks are supported
  - B'1': Fixed length blocks are supported
- Transfer Length: value from X'000000' to X'FFFFFF'. Although the maximum block size for this tape drive is X'200000' (2,097,152 bytes), any transfer length is accepted and the underlength condition rules are applied for transfer requests bigger than the actual block size. A transfer Length of X'000000' indicates that no bytes/blocks are transferred. This condition is not considered an error and the logical position is not changed.

A successful Read Reverse command with a Fixed bit of 1 transfers the requested Transfer Length, times the current block length in bytes to the initiator. A successful Read Reverse command with a Fixed bit of 0 transfers the requested Transfer Length in bytes to the initiator. Upon completion, the logical position is before the last block transferred (beginning-of-partition side).

If the SILI bit is B'1' and the Fixed bit is B'0', the target performs one of the following actions:

1. Report CHECK CONDITION status and associated sense data of 0/0000 (Incorrect Length, No Sense Data) for an incorrect length condition only if the

overlength condition exists (see SCSI section 10.4), and the Block Length field in the mode parameter block descriptor is nonzero (see SCSI section 8.3.3).

2. Not report CHECK CONDITION status if the only error is the underlength condition (see SCSI section 10.4), or if the only error is the overlength condition and Block Length field of the mode parameters block descriptor is B'0'. (See note 1.)

If the SILI bit is B'1' and the Fixed bit is B'1', the target terminates the command with CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

If the SILI bit is B'0' and an incorrect length block is read, CHECK CONDITION status is returned and the ILI and valid bits are set to B'1' in the sense data. Upon termination, the logical position is before the incorrect length block (beginning-of-partition side).

If the Fixed bit is B'1', the information field is set to the requested Transfer Length, minus the actual number of blocks read (not including the incorrect length block).

If the Fixed bit is B'0', the information field is set to the requested Transfer Length, minus the actual block length. Targets that do not support negative values set the information field to zero if the overlength condition exists (see SCSI section 10.4).

If the logical unit encounters a filemark during a Read Reverse command, CHECK CONDITION status is returned and the filemark and valid bits are set to B'1' in the sense data. The associated sense data is set to 0/0001 (No Sense, Filemark Detected). Upon termination, the logical position is before the filemark (beginning-of-partition side).

If the Fixed bit is B'1', the information field is set to the requested Transfer Length, minus the actual number of blocks read (not including the filemark). If the Fixed bit is B'0', the information field is set to the requested Transfer Length.

If the logical unit encounters beginning-of-medium during a Read Reverse command, CHECK CONDITION status is returned and the EOM and valid bits are set to B'1' in the sense data. Associated sense data is set to 0/0004 (No Sense, Beginning of Medium).

If the Fixed bit is B'1', the information field is set to the requested Transfer Length, minus the actual number of blocks transferred.

If the Fixed bit is B'0', the information field is set to the requested Transfer Length.

If the logical unit encounters End of Data (EOD) while reading, a sequence error is generated 3/1404 (Medium Error, Block Sequence Error).

Notes:

1. Because the residue information normally provided in the information field of the sense data may not be available when the SILI bit is set, use other methods for determining the actual block length (For example, including length information in the data block).
2. In the case of the Fixed bit of 1 with an overlength condition, only the position of the incorrect-length logical block can be determined from the sense data. The actual length of the incorrect block is not reported. Other means may be used to determine the actual length (for example, read it again with Fixed bit set to B'0').

Receive Diagnostic Results - X‘1C’

The Receive Diagnostic Results command is supported by the 3590 drive. After a Send Diagnostic command completes, use the Receive Diagnostic Results command to receive the results.

Note: For diagnostics that produce diagnostic results, the Receive Diagnostic Result command should be linked to the Send Diagnostic command, or the LUN should be reserved. See the *American National Standard Institute Small Computer System Interface X3T9.2/86-109 Revision 10h X3T39/89-042* standard for details.

Table 37 shows the command format.

Table 37. Receive Diagnostic Results Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1C')							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Allocation Length							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- Allocation Length is the maximum number of bytes to be returned in the page of data following the command (if any).
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Diagnostic Results Page Formats

The 3590 drive supports two diagnostic pages: Page Code X'00' and Page Code X'80'.

Page Code X'00'

The format for the Receive Diagnostic Results command follows:

Byte	Description
0	Page Code: X'00'
1	Reserved
2-3	Page Length: X'0002'
4	Page Code Supported: X'00'
5	Page Code Supported: X'80'

Page Code X'80'

Is a general purpose page for returning diagnostic data to the initiator. The format for the Receive Diagnostic Results command follows:

Byte	Description
0	Page Code: X'80'
1	Reserved
2-3	Page Length (n-3)

4-5 Diagnostic ID

This field contains the same value as that sent with the Send Diagnostic command for which this response is associated.

6 Flags

Set to X'00' for the Receive Diagnostic Results command

7 Reserved

8-n Diagnostic Results

The Diagnostic Results field contains the results from the diagnostic. See the individual Send Diagnostic parameter descriptions for the field contents.

Refer to “Magstar-Supported Diagnostics” on page 162 for a list of diagnostic parameters supported by the 3590 drive.

Recover Buffered Data - X‘14’

The Recover Buffered Data command is supported by the 3590 drive.

Table 38. Recover Buffered Data Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'14')							
1	Logical Unit Number			Reserved			SILI	Fixed
2	Transfer Length							
3								
4								
5	Control							

The following 3590-specific parameters apply:

- SILI (Suppress Incorrect Length Indicator): This bit is defined the same as for the Read command.
- Fixed: This bit is defined the same as for the Read command.
  - B'0': Variable length blocks are supported
  - B'1': Fixed length blocks are supported
- Transfer Length: value from X'000000' (zero bytes) to X'200000' (2,097,152 bytes)

Note: Having begun to recover data through the use of the Recover Buffer Data command, the initiator should not change the RBO (Recover Buffer Order) field in mode page X'10', until all the data in the buffer is read or until the device has received and successfully executed a Locate command, a Load Unload command, or a Rewind command. If the initiator attempts to change the RBO field while the device still has data in the buffers, the device rejects the command with associated sense data of with 5/2602 (Illegal Request, Parameter Value Invalid).

For further explanation, see “Data Transfer, Block Limits, and Fixed Block Option” on page 241.

Release Unit - X‘17’

The Release Unit command is supported by the 3590 drive. Table 39 shows the command format.

Table 39. Release Unit Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'17')							
1	Logical Unit Number			3rdPty	Third Party Device ID			Reserved
2	Reserved							
3	Reserved							
4	Reserved							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- 3rdPty (Third Party): B'0'
- Third Party Device ID: B'000'
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Report Density Support- X‘44’

The Report Density Support command is supported by the 3590 drive.

Table 40. Report Density Support

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'44')							
1	Reserved							Media
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Allocation Length							
9	Control Byte							

The following 3590-specific parameters apply:

- Media:
  - B'0' report all supported densities for all supported medium types
  - B'1' report all supported densities for the current medium in the drive
- Allocation Length is the maximum number of bytes to be transferred.
  - For E-Series Models, there are two densities supported by the device. The number of bytes returned will be 108 bytes.
  - For B-Series Models, there is one density supported by the device. The number of bytes returned will be 56 bytes.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

If Media = B'1' and the device is not ready, the drive will return 2/0400 (Not Ready, Not Ready Cause Not Reportable).

The Report Density Support data format returned is defined below:

Byte	Description
0-1	Available Density Support Length
2	Reserved
3	Reserved
4-n	Density Support Data Block Descriptors

The Report Density Block descriptor for High Performance Cartridge Tape and Extended High Performance Cartridge Tape is defined below. Note that his format applies to both the High Performance Cartridge Tape and Extended High Performance Cartridge Tape. The B-Series models return this format only.

Byte	Description
0	Primary Density Code: X'29'
1	Secondary Density Code: • E-Series models: X'29'

- B-Series models: X'00'

2

Bit	Description
7	WRTOK: • E-Series models: B'0' (The device cannot write this format) • B-Series models: B'1' (The device can write this format)
6	DUP: Only one data block for this density code. B'0'
5	DEFLT: • E-Series models: B'0' (This format is not the default format) • B-Series models: B'1' (This format is the default format)
4-0	Reserved

3 Reserved

4 Reserved

5-7 Bits Per MM: X'000D48'

8-9 Media Width (in millimeters): X'000D'

10-11 Tracks: X'0080'

12-15 Capacity (in Megabytes):
- Media Bit = B'0': X'00004E20'
- Media Bit = B'1':
  - High Performance Cartridge Tape is loaded: X'00002710'
  - Extended High Performance Cartridge Tape is loaded: X'00004E20'

16-23 Assigning Organization:
`'IBM    '`

(in ASCII)

24-31 Density Name
`'3590    '`

(in ASCII)

32-51 Description
`'        '`

(in ASCII)

Supported on E-Series models only, the Density Support data block descriptor for E-Format Density is defined below. Note that this format applies to both the High Performance Cartridge Tape and Extended High Performance Cartridge Tape.

Byte	Description
0	Primary Density Code: X'2A'
1	Secondary Density Code: 0
2	

Bit	Description
7	WRTOK: The device can write this format. B'1'
6	DUP: Only one data block for this density code. B'0'
5	DEFLT: This format is the default format: B'1'

4-0 Reserved

3 Reserved

4 Reserved

5-7 Bits Per MM: X'000D48'

8-9 Media Width (in millimeters): X'000D'

10-11 Tracks: X'0100'

12-15 Capacity (in Megabytes):

- Media Bit = B'0': X'00009C40'
- Media Bit = B'1':
  - High Performance Cartridge Tape is loaded: X'00004E20'
  - Extended High Performance Cartridge Tape is loaded: X'00009C40'

16-23 Assigning Organization:

```
'IBM     '
```

(in ASCII)

24-31 Density Name

```
'3590E   '
```

(in ASCII)

32-51 Description

```
'        '
```

(in ASCII)

Report LUNs - X‘A0’

The Report LUNs X'A0' command is supported by the Magstar drive. Table 41 shows the command format.

Table 41. Report LUNs Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation Code (X'A0')							
1	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Allocation Length							
7								
8								
9								
10	Reserved							
11	Control							

The following Magstar-specific parameters apply:

Allocation Length: The maximum number of bytes to be transferred.

The Report LUNs data format returned is defined below:

Byte **Description**

0-3 LUN List Length:
- If LUN 1 exists: 0x00000010
- If LUN 1 does not exist: 0x00000008

4-7 Reserved

8-15 First LUN: 0x0000000000000000

16-23 Second LUN: 0001000000000000 (returned only if LUN 1 exists)

Request Sense - X‘03’

The Request Sense command is supported by the 3590 drive. Table 42 shows the command format.

Table 42. Request Sense Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'03')							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Allocation Length							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- Allocation Length: The maximum number of bytes to be transferred.

  This device has 96 bytes of sense data. If the allocation length specified is less, then the allocated amount is transferred, the remaining sense data is lost, and no error is reported. If the allocated length specified is greater, then only 96 bytes of sense data are transferred and no error is reported.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

When acting as an Attached Medium Changer, the device returns sense data related to the drive as well as the library. When acting as an Independent Medium Changer, the device only returns sense data related to the LUN which has been specified.

The format of the sense data follows:

Byte **Description**

0

Bit	Description
7	Valid: • B'0' indicates that information bytes 3-6 are not valid. • B'1' indicates that information bytes 3-6 are valid.
6-0	Error Code (X'70' or X'71')

1 Segment Number: X'00'

2

Bit	Description
7	Filemark: • B'0' indicates that the current read command has not encountered a filemark. • B'1' indicates that the current read command has encountered a filemark. This device does not report Setmarks, per Mode Page 10, Byte 8(5).
6	EOM (End-Of-Medium): • B'0' indicates that the device is not at the end of medium.

- B'1' indicates that the device is at the end of medium.

5 ILI (Incorrect Length Indicator): This bit is set to B'1' if a Read command reads a block of incorrect length and the SILI field in the Read Command was set to B'0'.

4 Reserved

3-0 Sense Key: See “Appendix B. Error Sense Information” on page 233.

3-6 Information: The content of this field varies depending on the failing command and error. This field is only valid when the Valid bit (byte 0, bit 7) is set to B'1'.

- Non-Deferred Errors with Fixed bit = B'0':

  The Information field reflects the number of bytes (uncompacted) in the buffer.
- Non-Deferred Errors with Fixed bit = B'1':

  The Information field reflects the number of blocks in the buffer (regardless of block size).
- Deferred Errors and non-deferred errors for all other command types:
  - If the Block Length field in the block descriptor area of the Mode Select command is X'000000':

    The Information field reflects the number of bytes (uncompacted) in the buffer.
  - If the Block Length field in the block descriptor area of the Mode Select command is any value other than X'000000':

    The Information field reflects the number of blocks in the buffer.

7 Additional Sense Length (n-7): X'0A' or X'58'

- The 3590 drive supports a total of 96 bytes of sense data (a value of X'58' in the Additional Sense Length field). The first 18 bytes are standard.
- Only the first 18 bytes of sense data are returned (a value of X'0A' in the Additional Sense Length field) in association with an underlength condition for a read command with SILI bit of B'0' and a Fixed bit of B'0'.

8-11 Command-Specific Information: X'0000 0000'

The 3590 drive does not support the commands associated with this field.

12 Additional Sense Code: See “Appendix B. Error Sense Information” on page 233.

13 Additional Sense Code Qualifier: See “Appendix B. Error Sense Information” on page 233.

14 Field Replaceable Unit Code

Used to specify a failed FRU or FRU group. A non-zero value does not necessarily mean a FRU has been identified.

15-17 Sense Key Specific

When the sense key field value is Illegal Request, the SKSV bit is B'1' and bytes 15-17 are interpreted as follows:

Byte	Description
15	Sense Key Specific

Bit	Description
7	SKSV (Sense Key Specific Valid): B'1'
6	C/D (Control/Data):

- B'0' specifies that the error is in a data field of the parameter list.
- B'1' specifies that the error is in a CDB field.

5-4 Reserved

3 BPV (Bit Pointer Valid):
- B'0' specifies that the Bit Pointer Field is not valid.
- B'1' specifies that the Bit Pointer Field is valid.

2-0 Bit Pointer field
- When BPV is set to B'1', this field points to the bit in error of the field specified by the Field Pointer.

16-17 Field Pointer
- Points to the CDB byte or parameter byte in error.

When the sense key field value is not Illegal Request, the SKSV bit is B'0' and bytes 15-17 are interpreted as follows:

Byte	Description
15	Vendor-Unique Indicators

Bit	Description
7	SKSV (Sense Key Specific Valid): B'0'
6-3	Tape Position Indicators

Value	Description
0	BOT (Beginning of Tape)
1	Data
2	LEOP-EW (Logical End of Partition - Early Warning)
3	Data
4	LEOP (Logical End of Partition)

Bit	Description
2	Reserved
1	Permanent Error • B'0': Indicates that the error was recovered • B'1': Indicates that the error is permanent
0	SIM/MIM Flag • B'0': Indicates that a SIM/MIM is not available • B'1': Indicates that a SIM/MIM is available in Log Page X'31'

16-17	First Error Code
18	

Bit	Description
7	Reserved - Vendor-Unique
6	Sequential Medium Loader Active • B'0': Indicates there is not another cartridge available for processing in System or Automatic Mode. • B'1': Indicates there is another cartridge available for processing in System or Automatic Mode or the status is indeterminate.
5	Microcode Dump Available • B'0': Indicates there is no microcode dump currently available. • B'1': Indicates a microcode dump is available. Notify IBM Service personnel. The dump is lost at the next power off or operator panel reset.
4	DBM Invalid

Note: This field is not valid if the drive is not ready or when the sense data is associated with a prior CHECK CONDITION status (contingent allegiance condition).

- B'0': Indicates the Device Block Map is valid
- B'1': Indicates the Device Block Map is invalid

3-1 Reserved

0 Port Reporting Sense

- B'0': Indicates this sense reported on port 0
- B'1': Indicates this sense reported on port 1

19 SCSI IDs

Bit	Description
7-4	ID for Port 0
3-0	ID for Port 1

These fields contain the SCSI IDs of the two ports. These IDs can be changed from the operator's panel. When changed from the operator's panel, the permanent addresses stored in the VPD are also changed. The change to the IDs does not take effect until the next or Reset (issued from the Operator's panel).

The SCSI IDs can be temporarily changed using the Change SCSI ID diagnostic routine. Although a port ID may be temporarily changed by this routine, the default value of the port ID is given in this sense command, not the temporary value assigned.

20 ACF Status

Bit	Description
7-4	Reserved
3	Magazine Lock • B'0': The cartridges may be removed from the magazine. • B'1': The cartridges are locked in the magazine.
2	Reserved
1	Magazine Available • B'0': The magazine is not mounted in the ACF. • B'1': The magazine is mounted in the ACF.

A magazine removed from the ACF causes CHECK CONDITION status to be prepared with associated sense data of 6/3B12 (Unit Attention, Medium Magazine Removed).

0 Reserved

21-22 Reserved - Vendor-Unique

23

Bit	Description
7-4	Medium Access Field

Value	Description
0	Position unknown (during power-on initialization or unusual conditions)
1	Load error (cartridge loaded, but drive not ready)
4	Cartridge unloaded or removed
5	Cartridge is currently loading
6	Cartridge is currently unloading
9	Cartridge is loaded

Note: other values are possible, but undefined.

3-0 Reserved

24 Medium Descriptor flags

Bit	Description
7	Initialization Required • B'0': Not defined. • B'1': The medium requires initialization. The device cannot detect initialization on the volume at BOV.
6	VCR Integrity Check • B'0': Not defined. • B'1': An error condition is detected in the volume control region of the medium
5	Partitioned **Note:** Partitioning of a volume is not currently supported, but may be in the future. • B'0': The volume does not have multiple partitions. • B'1': The volume has multiple partitions.
4	Partitioning Integrity **Note:** Partitioning of a volume is not currently supported, but may be in the future. • B'0': Not defined. • B'1': An error condition is detected in the partitioning definition of the VCR.
3	Medium Check • B'0': Not defined. • B'1': A medium check was detected for the medium, and the medium cannot be processed by the device.
2	Incompatible Format • B'0': Not defined. • B'1': The device does not recognize the format of the medium.
1	PWP (Physical Write Protect) • B'0': The volume Physical Write Protect switch is off. • B'1': The volume Physical Write Protect switch is on.
0	Logical Write Protect • B'0': The volume is not logically write protected. • B'1': The volume is logically write protected.

25 Reserved - Vendor-Unique

26-29 Reserved - Vendor-Unique

30 Failing Command

- Request under execution at time of error

31-32 First Error Code Flag Data

- Optional encoded flag data for bytes 16-17

33-34 Second Error Code

- Second error code encountered

35-36 Second Error Code Flag Data

- Optional encoded flag data that relates to the second error code

37-38 Next-to-Last Error Code

- Next-to-last error code encountered

39-40 Next-to-Last Error Code Flag Data

- Optional encoded flag data that relates to the next-to-last error code

41-42 Last Error Code

- Last error code encountered

43-44 Last Error Code Flag Data

- Optional encoded flag data that relates to the last error code

45 Reserved

46-49 Logical Block Number

- The next block that would be accessed in the forward direction

50-52 Device Block Number

- The number of the current physical device block (Bytes 13-15 in Block Control). Valid values are from X'000000' to X'FFFFFF'

53 Wrap Half and Direction

Bit	Description
7-4	Reserved
3-1	Wrap Number
0	Wrap Direction • B'0': Physical Forward Wrap Half • B'1': Physical Backward Wrap Half

54-55 Partition Number

Note: Partitioning of a volume is not currently supported, but may be in the future.

- X'0000-00FF'

56 Device Block Control Flag

Bit	Description
7-6	Block Control Field Format **Value** **Description** **0** 3590 block control field format **1-3** Reserved
5	Beginning of Partition **Note:** Partitioning of a volume is not currently supported, but may be in the future. • B'0': The drive is not positioned at the BOP. • B'1': The drive is positioned at the BOP.
4-2	Reserved
1	Logical Block Input Spanning
0	Logical Block Output Spanning

57 Device Block Type ID

- The identification of the device block type

58-61 First Logical Block Number

- Contains the device block number of the first host logical block that is at least partially contained within the current device block

62-63 Number of Logical Blocks in the device block

- The number of logical blocks that are at least partially contained within the current device block

64 Number of MIUs in the device block

- The number of MIUs that are contained in the device block

65-68 Volume Recipe/Step Index

69 Error Recovery Summary Qualifier

70 Cleaning Required Indicator (Static)

Bit	Value

7 B'1': Cleaning Required - Normal Maintenance

Reset to B'0' when the cleaning cartridge is loaded.

6 B'1': Cleaning Required - Threshold Reached

Reset to B'0' when the cleaning cartridge is loaded.

5-0 Reserved

71 Reserved

72-78 Microcode EC Number (in ASCII)

79 Reserved

80 Volume Label Flags

Bit	Description
7	Volume Label Fields Valid • B'0': Indicates sense bytes 81-88 are not valid. • B'1': Indicates sense bytes 81-88 are valid for the media that is loaded.
6	Volume Label Source External • B'0': Indicates the source of sense bytes 81-88 is block 0 of the media. • B'1': Indicates the source of sense bytes 81-88 is the cartridge bar code label.
5	Volume Label is EBCDIC • B'0': Indicates Volume Label is in ASCII • B'1': Indicates Volume Label is in EBCDIC
4-0	Reserved

81 Reserved

82 Volume Label Cartridge Type

Value	Description
'J' (in ASCII)	Magstar High Performance Cartridge Tape
'K' (in ASCII)	Magstar Extended High Performance Cartridge Tape

83-88 Volume Label (in ASCII or EBCDIC, depending on the source)

89-95 Reserved

Reserve Unit - X‘16’

The Reserve Unit command is supported by the 3590 drive. Table 43 shows the command format.

Table 43. Reserve Unit Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'16')							
1	Logical Unit Number			3rdPty	Third Party Device ID			Reserved
2	Reserved							
3	Reserved							
4	Reserved							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- 3rdPty (Third Party): B'0'
- Third Party Device ID: B'000'
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Note: Reserves are honored across initiator as well as port boundaries. For additional information, see “Multiple Port Behavior” on page 239.

Rewind - X‘01’

The Rewind command is supported by the 3590 drive. Table 44 shows the command format.

Table 44. Rewind Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'01')							
1	Logical Unit Number			Reserved				Immed
2	Reserved							
3	Reserved							
4	Reserved							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- Immed (Immediate):
  - B'0': present status when command is completed.
  - B'1': present status when all buffered data is successfully written to the media.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Send Diagnostic - X‘1D’

The Send Diagnostic command is supported by the 3590 drive. Send Diagnostic is used to execute the 3590 diagnostics and to perform special functions that would normally only be available from the operator panel.

Note: For diagnostics that produce diagnostic results, the Receive Diagnostic Result command should be Linked to the Send Diagnostic command, or the LUN should be reserved. See the referenced SCSI-2 specification for details.

Table 45 shows the command format.

Table 45. Send Diagnostic Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number			PF	Reserved	SelfTest	DevOfl	UnitOfl
2	Reserved							
3	Parameter List Length							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

PF (Page Format)

Set to B'1'.

SelfTest

The values can be the following:

- B'0': perform the diagnostic operation specified in the parameter list.
- B'1': perform self-test. See “Self-Test” on page 164 for details of this diagnostic.

Note: When Self-Test is requested, no other diagnostics may be simultaneously requested.

DevOfL (Device Off Line)

The values can be the following:

- B'0' is supported and prohibits any diagnostic operations that may be detected by subsequent I/O processes.
- B'1' is supported and grants permission to the target to perform diagnostic operations that may affect all the logical units on a target; that is, alteration of reservations, log parameters, or sense data.
- B'x' in the diagnostic description indicates that either B'0' or B'1' may be used with identical effects.

Note: DevOfl and UnitOfl are set by the system. These bits grant permission to the target to perform vendor-specific diagnostic operations on the target that may be visible to attached initiators. Thus, by preventing operations that are not enabled by these bits, the target assists the operating system in protecting its resources.

UnitOfL (Unit Off Line)

The values can be the following:

- B'0' is supported and prohibits any diagnostic operations that may be detected by subsequent I/O processes.
- B'1' is supported and grants permission to the target to perform diagnostic operations that may affect the user medium on the logical unit; for example, write operations to the user-accessible medium, or operations that reposition the medium on sequential access devices.
- B'x' in the diagnostic description indicates that either B'0' or B'1' may be used with identical effects.

Parameter List Length

This field specifies the length in bytes of the parameter list that is transferred from the initiator to the target.

A parameter list length value of zero specifies that no data is transferred. This condition is not considered an error. If the specified parameter list length results in truncation of one or more pages (PF bit set to 1), the target returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field in CDB).

Flag and Link

See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Diagnostic Page Formats

The 3590 drive supports two diagnostic page formats: Page Code X'00' and Page Code X'80'.

Page Code X'00'

The format for the Send Diagnostic command follows:

Byte	Description
0	Page Code: X'00'
1	Reserved (X'00')
2-3	Page Length: X'0000'

Page Code X'80'

Is a general purpose page for sending flags and diagnostic parameters to the target. The format for the Send Diagnostic command follows:

Byte	Description
0	Page Code: X'80'
1	Reserved
2-3	Page Length (n-3)
4-5	Diagnostic ID This field specifies the diagnostic that is to be run
6	Flags (Send Diagnostic command) **Bits** **Description** **7-1** Reserved **0** Cartridge Required Set to 1 when a cartridge is required for a diagnostic. When 1, a cartridge must be loaded and ready for the Send Diagnostic command to be accepted. See specific diagnostic descriptions for cartridge use: some diagnostics require this bit to be set to 1, some require it to be set to 0, and some do not require a specific bit setting. • B'0': No cartridge required • B'1': Cartridge required
7	Reserved
8-n	Diagnostic Parameters The Diagnostic Parameters field contains the parameters required to run the diagnostic.

See “Magstar-Supported Diagnostics” for a list of diagnostic routines supported by the 3590 drive.

Magstar-Supported Diagnostics

Table 46 on page 163 shows the diagnostic routines supported by the Magstar drive. These diagnostics reside in the device. (See “Send Diagnostic - X‘1D’” on page 160 and “Receive Diagnostic Results - X‘1C’” on page 143 for additional information on the commands.) Individual diagnostic descriptions follow Table 46 on page 163.

Table 46. Supported Diagnostic Routines

Diagnostic Name	Diagnostic ID	See Page
Self-Test	None	164
Change SCSI ID	X'0001'	165
POST A Diagnostic	X'0100'	167
POST B Diagnostic	X'0101'	169
ACF Diagnostic	X'0102'	171
Force Dump	X'0160'	173
Write Dump to Cartridge	X'0161'	174
Create FMR Cartridge	X'0170'	176
Set Traps	X'0190'	178
Remove Traps	X'0191'	179
Set Drive Parameters	X'2000'	180
Reset VSARS	X'2001'	181
Reset Drive	X'2002'	182

The Change SCSI ID and the ACF Diagnostics require the drive to have no cartridge loaded.

Self-Test

When you set the SelfTest (SelfTest) bit to 1 in a Send Diagnostic command, the target runs the normal power-on self-test (POST A) diagnostics that occur at bring-up. No diagnostic results are returned.

Send Diagnostic Command — Self-Test

Table 47 shows the Send Diagnostic command format to specify Self-Test (the SelfTest bit is set to 1).

Table 47. Send Diagnostic Command — Self-Test

Bit **Byte**	**7** **MSB**	**6**	**5**	**4**	**3**	**2**	**1**	**0** **LSB**
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	**SelfTest (B'1')**	DevOfl (B'0')	UnitOfl (B'0')
2	Reserved (X'00')							
3	Parameter List Length (X'0000')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

When you set the SelfTest bit to 1 in a Send Diagnostic command, you direct the target to complete its default power-on self-test. If the self-test successfully passes, the command is terminated with Good status. If the self-test detects a failure, the command is terminated with CHECK CONDITION status and the sense key is set to Hardware Error.

Receive Diagnostic Results Command — Self-Test

There are no diagnostic results for the self-test.

Change SCSI ID Diagnostic

Allows an initiator to change the SCSI ID of the selected target from its current setting to a specified new target address. After the diagnostic completes successfully, the target responds only to the new SCSI ID until the target receives a power-on reset (POR). After a power-on reset, the target responds only to its default SCSI ID. The temporary SCSI ID is discarded. The address on the other SCSI port is unchanged by this operation.

Send Diagnostic Command — Change SCSI ID

Table 48 shows the Send Diagnostic command format to specify Change SCSI ID.

Table 48. Send Diagnostic Command — Change SCSI ID

Bit / Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'1')	UnitOfl (B'x')
2	Reserved (X'00')							
3	Parameter List Length (X'0009')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Note:

Either the Link bit should be set or the LUN should be reserved if the Receive Diagnostic Results SCSI command is issued.

Send Diagnostic Parameter Data — Change SCSI ID

Table 49 shows the parameter data for the Send Diagnostic command.

Table 49. Send Diagnostic Parameter Data — Change SCSI ID

Bit / Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0005')							
3								
4	Diagnostic ID (X'0001')							
5								
6	Flags (X'00')							
7	Reserved (X'00')							
8	Reserved (X'0')				New SCSI ID			

Note:

Because the Flags field is set to X'00', any cartridge in the drive is unloaded.

Receive Diagnostic Results Command — Change SCSI ID

The initiator issues a Receive Diagnostic Results to the old SCSI ID, which returns Page Code X'80' with the default SCSI ID, the new SCSI ID, and the Diagnostic ID.

The target SCSI ID is modified after the Receive Diagnostic Results command is successfully received. The default SCSI ID is unchanged by this process. The change of SCSI ID is only applicable to the SCSI port on which the diagnostic is performed. Any reservations for all LUNs under the target are reset when the ID is changed.

The target maintains the new SCSI ID until either a POR is received (at which time it reverts to the default SCSI ID stored), or until it receives another Change SCSI ID diagnostic command.

Table 50 shows the Receive Diagnostic Results command format for the Change SCSI ID diagnostic.

Table 50. Receive Diagnostic Results Command — Change SCSI ID

Bit **Byte**	**7** **MSB**	**6**	**5**	**4**	**3**	**2**	**1**	**0** **LSB**
0	Operation code (X'1C')							
1	Logical Unit Number B'000'			Reserved (B'00000')				
2	Reserved (X'00')							
3	Allocation Length							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Receive Diagnostic Results Data — Change SCSI ID

Table 51 shows the diagnostic results data received from the Change SCSI ID diagnostic.

Table 51. Receive Diagnostic Results Data — Change SCSI ID

Bit **Byte**	**7** **MSB**	**6**	**5**	**4**	**3**	**2**	**1**	**0** **LSB**
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0006')							
3								
4	Diagnostic ID (X'0001')							
5								
6	Flags (X'00')							
7	Reserved (X'00')							
8	Reserved (X'0')				New SCSI ID			
9	Reserved (X'0')				Default SCSI ID			

POST A Diagnostic

This diagnostic runs the POST A (power-on self-test) diagnostics, as does running the Self-Test diagnostic by setting the SelfTest bit to 1 in a Send Diagnostic command. However, unlike Self-Test, the POST A diagnostic returns data through the Receive Diagnostic Results command.

Send Diagnostic Command — POST A

Table 52 shows the Send Diagnostic command format to specify running the POST A diagnostic.

Table 52. Send Diagnostic Command — POST A

Bit / Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'x')	UnitOfl (B'x')
2	Reserved (X'00')							
3	Parameter List Length (X'0008')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Note:

Either the Link bit should be set or the LUN should be reserved if the Receive Diagnostic Results SCSI command is issued.

Send Diagnostic Parameter Data — POST A

Table 53 shows the parameter data for the Send Diagnostic command.

Table 53. Send Diagnostic Parameter Data — POST A

Bit / Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0004')							
3								
4	Diagnostic ID (X'0100')							
5								
6	Flags (B'0000000')							Cartridge Required (B'x')
7	Reserved (X'00')							

Note:

The Cartridge Required flag can be set to 0 or 1. If a cartridge is in the drive when this diagnostic is received, some diagnostics will not run. If the diagnostic is blocked because a cartridge is loaded in the drive or for any other reason, the Diagnostic Blocked bit is set in the Receive Diagnostics Results data.

Receive Diagnostic Results Command — POST A

Table 54 shows the Receive Diagnostic Results command format for the POST A diagnostic.

Table 54. Receive Diagnostic Results Command — POST A

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1C')							
1	Logical Unit Number B'000'			Reserved (B'00000')				
2	Reserved (X'00')							
3	Allocation Length							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Receive Diagnostic Results Data — POST A

Table 55 shows the diagnostic results data received from the POST A diagnostic.

Table 55. Receive Diagnostic Results Data — POST A

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'004D')							
3								
4	Diagnostic ID (X'0100')							
5								
6	Flags (X'00')							
7	Reserved (X'00')							
8	Reserved (B'00000')					Diagnostic Blocked	SIM/MIM Present	Error
9-80	SIM/MIM message or all zeros							

Note:

The Error bit in byte 8 is set when the diagnostic detects an error.

The SIM/MIM Present bit in byte 8 is set when a SIM or MIM message is contained in the diagnostic results.

SIM/MIM messages are defined exactly as described under the Log Sense command, Page Code X'31'; the SIM/MIM is not valid if the SIM/MIM Present bit is 0.

The Diagnostic Blocked bit is set when the diagnostic cannot run all its tests. This occurs if a cartridge is in the drive.

POST B Diagnostic

This diagnostic causes all of the 3590 drive read, write, and motion test diagnostics to be executed. Thus, a cartridge is required to be loaded to run the diagnostic.

Send Diagnostic Command — POST B

Table 56 shows the Send Diagnostic command format to specify running the POST B diagnostic.

Table 56. Send Diagnostic Command — POST B

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'x')	UnitOfl (B'1')
2	Reserved (X'00')							
3	Parameter List Length (X'0008')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Note:

Either the Link bit should be set or the LUN should be reserved if the Receive Diagnostic Results SCSI command is issued.

Send Diagnostic Parameter Data — POST B

Table 57 shows the parameter data for the Send Diagnostic command.

Table 57. Send Diagnostic Parameter Data — POST B

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0004')							
3								
4	Diagnostic ID (X'0101')							
5								
6	Flags (B'0000000')							Cartridge Required (B'1')
7	Reserved (X'00')							

Note:

Because the Cartridge Required flag is set to 1, a cartridge must be loaded and ready before the diagnostic is run.

Receive Diagnostic Results Command - POST B

Table 58 shows the Receive Diagnostic Results command format for the POST B diagnostic.

Table 58. Receive Diagnostic Results Command — POST B

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1C')							
1	Logical Unit Number B'000'			Reserved (B'00000')				
2	Reserved (X'00')							
3	Allocation Length							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Receive Diagnostic Results Data - POST B

Table 59 shows the diagnostic results data received from the POST B diagnostic.

Table 59. Receive Diagnostic Results Data — POST B

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'004D')							
3								
4	Diagnostic ID (X'0101')							
5								
6	Flags (X'00')							
7	Reserved (X'00')							
8	Reserved (B'00000')					Diagnostic Blocked	SIM/MIM Present	Error
9-80	SIM/MIM message or all zeros							

Note:

The Error bit in byte 8 is set when the diagnostic detects an error.

The SIM/MIM Present bit in byte 8 is set when a SIM or MIM message is contained in the diagnostic results.

SIM/MIM messages are defined exactly as described under the Log Sense command, Page Code X'31'; the SIM/MIM is not valid if the SIM/MIM Present bit is 0.

ACF Diagnostic

This command causes all the ACF functions to be executed on ACF models, including the ACF/drive interface.

Send Diagnostic Command - ACF

Table 60 shows the Send Diagnostic command format to specify running the ACF Diagnostic.

Table 60. Send Diagnostic Command — ACF

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'x')	UnitOfl (B'x')
2	Reserved (X'00')							
3	Parameter List Length (X'0008')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Note:

Either the Link bit should be set or the LUN should be reserved if the Receive Diagnostic Results SCSI command is issued.

Send Diagnostic Parameter Data - ACF

Table 61 shows the parameter data for the Send Diagnostic command.

Table 61. Send Diagnostic Parameter Data — ACF

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0004')							
3								
4	Diagnostic ID (X'0102')							
5								
6	Flags (B'0000000')							Cartridge Required (B'0')
7	Reserved (X'00')							

Note:

The Cartridge Required flag must be set to 0.

Receive Diagnostic Results Command - ACF

Table 62 shows the Receive Diagnostic Results command format for the ACF Diagnostic.

Table 62. Receive Diagnostic Results Command — ACF

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1C')							
1	Logical Unit Number B'000'			Reserved (B'00000')				
2	Reserved (X'00')							
3	Allocation Length							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Receive Diagnostic Results Data - ACF

Table 63 shows the diagnostic results data received from the ACF Diagnostic.

Table 63. Receive Diagnostic Results Data - ACF

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'004D')							
3								
4	Diagnostic ID (X'0102')							
5								
6	Flags (X'00')							
7	Reserved (X'00')							
8	Reserved (B'000000')					Diagnostic Blocked	SIM/MIM Present	Error
9-80	SIM/MIM message or all zeros							

Note:

The Error bit in byte 8 is set when the diagnostic detects an error.

The SIM/MIM Present bit in byte 8 is set when a SIM or MIM message is contained in the diagnostic results.

SIM/MIM messages are defined exactly as described under the Log Sense command, Page Code X'31'; the SIM/MIM is not valid if the SIM/MIM Present bit is 0.

Force Dump Diagnostic

This diagnostic forces a dump. The dump data is stored in 3590 drive control storage and can be read by the Read Buffer command (Buffer ID of X'00'). See “Read Buffer - X‘3C’” on page 134.

When a higher priority dump has been generated automatically by the drive but has not yet been read, the drive will ignore this Send Diagnostic command and return GOOD status.

Send Diagnostic Command — Force Dump

Table 64 shows the Send Diagnostic command format to specify Force Dump.

Table 64. Send Diagnostic Command — Force Dump

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'x')	UnitOfl (B'x')
2	Reserved (X'00')							
3	Parameter List Length (X'0008')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Send Diagnostic Parameter Data — Force Dump

Table 65 shows the parameter data for the Send Diagnostic command.

Table 65. Send Diagnostic Parameter Data — Force Dump

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0004')							
3								
4	Diagnostic ID (X'0160')							
5								
6	Flags (B'0000000')							Cartridge Required (B'x')
7	Reserved (X'00')							

Note:

The Cartridge Required flag can be set to 0 or 1.

Receive Diagnostic Results Command — Force Dump

There are no diagnostic results for this function.

Write Dump to Cartridge Diagnostic

This diagnostic causes dump information residing in the 3590 drive control storage to be written to a cartridge without the need to retrieve the dump data across the SCSI interface. A cartridge is required to be loaded to run the diagnostic.

Send Diagnostic Command - Write Dump to Cartridge

Table 66 shows the Send Diagnostic command format to specify Write Dump to Cartridge.

Table 66. Send Diagnostic Command — Write Dump to Cartridge

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'x')	UnitOfl (B'1')
2	Reserved (X'00')							
3	Parameter List Length (X'0008')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Note:

Either the Link bit should be set or the LUN should be reserved if the Receive Diagnostic Results SCSI command is issued.

Send Diagnostic Parameter Data — Write Dump to Cartridge

Table 67 shows the parameter data for the Send Diagnostic command.

Table 67. Send Diagnostic Parameter Data — Write Dump to Cartridge

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0004')							
3								
4	Diagnostic ID (X'0161')							
5								
6	Flags (B'0000000')							Cartridge Required (B'1')
7	Reserved (X'00')							

Note:

Because the Cartridge Required flag is set to 1, a cartridge must be loaded and ready before the diagnostic is run.

Receive Diagnostic Results Command - Write Dump to Cartridge

Table 68 shows the Receive Diagnostic Results command format for the Write Dump to Cartridge diagnostic.

Table 68. Receive Diagnostic Results Command — Write Dump to Cartridge

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1C')							
1	Logical Unit Number B'000'			Reserved (B'00000')				
2	Reserved (X'00')							
3	Allocation Length							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Receive Diagnostic Results Data — Write Dump to Cartridge

Table 69 shows the diagnostic results data received from the Write Dump to Cartridge diagnostic.

Table 69. Receive Diagnostic Results Data — Write Dump to Cartridge

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'004D')							
3								
4	Diagnostic ID (X'0161')							
5								
6	Flags (X'00')							
7	Reserved (X'00')							
8	Reserved (B'00000')					Diagnostic Blocked	SIM/MIM Present	Error
9-80	SIM/MIM message or all zeros							

Note:

The Error bit in byte 8 is set if an error occurs while writing the tape.

The SIM/MIM Present bit in byte 8 is set when a SIM or MIM message is contained in the diagnostic results.

SIM/MIM messages are defined exactly as described under the Log Sense command, Page Code X'31'; the SIM/MIM is not valid if the SIM/MIM Present bit is 0.

Create FMR Cartridge Diagnostic

This diagnostic causes the 3590 drive microcode to write a copy to a cartridge to make it a field microcode replacement (FMR) cartridge. A cartridge is required to be loaded to run the diagnostic.

This permits you to copy a functional microcode load onto a cartridge for transporting to another drive when a FMR cartridge is not available.

Note: This function is also available from the operator panel.

Send Diagnostic Command - Create FMR Cartridge

Table 70 shows the Send Diagnostic command format to specify Create FMR Cartridge.

Table 70. Send Diagnostic Command — Create FMR Cartridge

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'x')	UnitOfl (B'1')
2	Reserved (X'00')							
3	Parameter List Length (X'0008')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Note:

Either the Link bit should be set or the LUN should be reserved if the Receive Diagnostic Results SCSI command is issued.

Send Diagnostic Parameter Data — Create FMR Cartridge

Table 71 shows the parameter data for the Send Diagnostic command.

Table 71. Send Diagnostic Parameter Data — Create FMR Cartridge

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0004')							
3								
4	Diagnostic ID (X'0170')							
5								
6	Flags (B'0000000')							Cartridge Required (B'1')
7	Reserved (X'00')							

Note:

Because the Cartridge Required flag is set to 1, a cartridge must be loaded and ready before the diagnostic is run.

Receive Diagnostic Results Command - Create FMR Cartridge

Table 72 shows the Receive Diagnostic Results command format for the Create FMR Cartridge diagnostic.

Table 72. Receive Diagnostic Results Command — Create FMR Cartridge

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1C')							
1	Logical Unit Number B'000'			Reserved (B'00000')				
2	Reserved (X'00')							
3	Allocation Length							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Receive Diagnostic Results Data - Create FMR Cartridge

Table 73 shows the diagnostic results data received from the Create FMR Cartridge diagnostic.

Table 73. Receive Diagnostic Results Data — Create FMR Cartridge

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'004D')							
3								
4	Diagnostic ID (X'0170')							
5								
6	Flags (X'00')							
7	Reserved (X'00')							
8	Reserved (B'000000')					Diagnostic Blocked	SIM/MIM Present	Error
9-80	SIM/MIM message or all zeros							

Note:

The Error bit in byte 8 is set if an error occurs while creating the FMR cartridge.

The SIM/MIM Present bit in byte 8 is set when a SIM or MIM message is contained in the diagnostic results.

SIM/MIM messages are defined exactly as described under the Log Sense command, Page Code X'31'; the SIM/MIM is not valid if the SIM/MIM Present bit is 0.

Set Traps Diagnostic

This diagnostic permits a SCSI interface user to set a microcode trap that causes a dump to occur when the trap is sprung. The drive continues to operate after the dump completes.

Send Diagnostic Command - Set Traps

Table 74 shows the Send Diagnostic command format to specify Set Traps.

Table 74. Send Diagnostic Command - Set Traps

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'x')	UnitOfl (B'x')
2	Reserved (X'00')							
3	Parameter List Length (X'000A')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Send Diagnostic Parameter Data — Set Traps

Table 75 shows the parameter data for the Send Diagnostic command.

Table 75. Send Diagnostic Parameter Data — Set Traps

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0006')							
3								
4	Diagnostic ID (X'0190')							
5								
6	Flags (B'0000000')							Cartridge Required (B'x')
7	Reserved (X'00')							
8	Fault Symptom Code							
9								

Note:

If the Cartridge Required flag is set to 1, a cartridge must be loaded and ready before the diagnostic is run.

Receive Diagnostic Results Command - Set Traps

There are no diagnostic results for this function.

Remove Traps Diagnostic

This diagnostic permits a SCSI interface user to remove a microcode trap that was set either via the operator panel or the SCSI Set Traps Diagnostic.

Send Diagnostic Command - Remove Traps

Table 76 shows the Send Diagnostic command format to specify Remove Traps.

Table 76. Send Diagnostic Command - Remove Traps

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'x')	UnitOfl (B'x')
2	Reserved (X'00')							
3	Parameter List Length (X'000A')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Send Diagnostic Parameter Data Remove Traps

Table 77 shows the parameter data for the Send Diagnostic command.

Table 77. Send Diagnostic Parameter Data — Remove Traps

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0006')							
3								
4	Diagnostic ID (X'0191')							
5								
6	Flags (B'0000000')							Cartridge Required (B'x')
7	Reserved (X'00')							
8	Fault Symptom Code							
9								

Note:

If the Cartridge Required flag is set to 1, a cartridge must be loaded and ready before the diagnostic is run.

Receive Diagnostic Results Command - Remove Traps

There are no diagnostic results for this function.

Set Drive Parameters Diagnostic

This diagnostic changes selected 3590 drive parameters.

Send Diagnostic Command - Set Drive Parameters

Table 78 shows the Send Diagnostic command format to specify running the Set Drive Parameters diagnostic.

Table 78. Send Diagnostic Command — Set Drive Parameters

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'1')	UnitOfl (B'x')
2	Reserved (X'00')							
3	Parameter List Length (X'0014')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Send Diagnostic Parameter Data — Set Drive Parameters

Table 79 shows the parameter data for the Send Diagnostic command.

Table 79. Send Diagnostic Parameter Data — Set Drive Parameters

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0010')							
3								
4	Diagnostic ID (X'2000')							
5								
6	Flags (B'0000000')							Cartridge Required (B'0')
7	Reserved (X'00')							
8	Tension Value							
9								
10	Compressor Value							
11								
12	Reserved (B'0000000')							Single MIU Mode
13	Reserved (X'00')							
14	Reserved (X'00')							
15	Reserved (X'00')							
16	Reserved (X'00')							
17	Reserved (X'00')							
18	Reserved (X'00')							
19	Reserved (X'00')							

Receive Diagnostic Results Command - Set Drive Parameters

There are no diagnostic results for this function.

Reset VSARS Diagnostic

This diagnostic resets the VOLUME SARS data in the 3590 drive.

Send Diagnostic Command - Reset VSARS

Table 80 shows the Send Diagnostic command format to specify running the Set Drive Parms diagnostic.

Table 80. Send Diagnostic Command — Reset VSARS

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'1')	UnitOfl (B'x')
2	Reserved (X'00')							
3	Parameter List Length (X'0008')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Send Diagnostic Parameter Data — Reset VSARS

Table 81 shows the parameter data for the Send Diagnostic command.

Table 81. Send Diagnostic Parameter Data — Reset VSARS

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0004')							
3								
4	Diagnostic ID (X'2001')							
5								
6	Flags (B'0000000')							Cartridge Required (B'1')
7	Reserved (X'00')							

Receive Diagnostic Results Command — Reset VSARS

There are no diagnostic results for this function.

Reset Drive Diagnostic

This diagnostic aborts all current drive operations and restarts the functional microcode. This reset is equivalent to a power on reset. (This function can also be specified from the operator panel.)

Send Diagnostic Command - Reset Drive

Table 82 shows the Send Diagnostic command format to specify Reset Drive.

Table 82. Send Diagnostic Command — Reset Drive

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'1D')							
1	Logical Unit Number B'000'			PF (B'1')	Reserved (B'0')	SelfTest (B'0')	DevOfl (B'x')	UnitOfl (B'x')
2	Reserved (X'00')							
3	Parameter List Length (X'0008')							
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

Send Diagnostic Parameter Data - Reset Drive

Table 83 shows the parameter data for the Send Diagnostic command.

Table 83. Send Diagnostic Parameter Data — Reset Drive

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Page Code (X'80')							
1	Reserved (X'00')							
2	Page Length (X'0004')							
3								
4	Diagnostic ID (X'2002')							
5								
6	Flags (B'0000000')							Cartridge Required (B'0')
7	Reserved (X'00')							

Receive Diagnostic Results Command — Reset Drive

There are no diagnostic results for this function.

Space - X‘11’

The Space command is supported by the 3590 drive. With the 3590 medium format, this command is implemented similar to the Locate command, causing the tape to move at high speed when appropriate (5 m/s). Table 84 shows the command format.

Table 84. Space Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'11')							
1	Logical Unit Number			Reserved		Code		
2	Count							
3								
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- Code

  The following codes are supported:
  - B'000' Blocks
  - B'001' Filemarks
  - B'010' Sequential Filemarks
  - B'011' End of Data
- Count

  When spacing over blocks or filemarks, the count field specifies the number of blocks or filemarks to be spaced over in the current partition. A positive value N in the count field causes forward positioning (toward End of Partition) over N blocks or filemarks ending on the End of Partition side of the last block or filemark. A zero value in the count field causes no change of logical position. A negative value -N (two’s complement notation) in the count field causes reverse positioning (toward Beginning Of Partition) over N blocks or filemarks ending on the Beginning of Partition side of the last block or filemark.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

If the drive encounters End-of-Data (EOD) while executing this command, the command is terminated at the EOD position and CHECK CONDITION status is returned with associated sense data of 8/0005 (Blank Check, End-of-Data Detected). If the next motion command is another request to move forward (beyond EOD), the drive accepts the command and attempts to position beyond EOD in order to allow recovery of old data.

B-Series models cannot read or space on an E-Format tape. If such an attempt is made, CHECK CONDITION status is returned and Associated sense data is set to 3/3002 (Medium Error, Cannot Read Medium - Incompatible Format).

Test Unit Ready - X‘00’

The Test Unit Ready command is supported by the 3590 drive. Table 85 shows the command format.

Table 85. Test Unit Ready Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'00')							
1	Logical Unit Number			Reserved				
2	Reserved							EDCC
3	Reserved							
4	Reserved							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- EDCC (Enable Deferred CHECK CONDITION):
  - B'0': Deferred CHECK CONDITION status is not to be reported for this command.
  - B'1': Deferred CHECK CONDITION status may be reported for this command.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Write - X‘0A’

The Write command is supported by the 3590 drive. Table 86 shows the command format.

Table 86. Write Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'0A')							
1	Logical Unit Number			Reserved				Fixed
2	Transfer Length							
3								
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- The Fixed option of the Write command is supported. See also “Data Transfer, Block Limits, and Fixed Block Option” on page 241.
- Transfer Length: value from X'000000' (zero bytes) to X'200000' (2,097,152 bytes). A Transfer Length of X'000000' indicates that no data is transferred. This condition is not considered an error and the logical position is not changed.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Note: A tape may only be one format at a time. 3590 B-Series models write using B-Format (density code X'29') and E-Series models write using E-Format (density code X'2A'). At Beginning Of Tape, any tape previously written in one format can be changed to another format when a Write command is issued. If an attempt is made by an E-series model to write a B-Format tape at any other location away from Beginning of Tape. CHECK CONDITION status is returned with associated sense data of 5/3005 (Illegal Request, Cannot Write Medium - Incompatible Format). Since a B-Series model cannot read an E-Format tape, this condition cannot happen on a B-Series model.

Write Buffer - X‘3B’

The Write Buffer command is supported, but not all buffers are described in this document because most buffers are intended only to be written by the service representative or by manufacturing. OEM customers who intend to support host microcode download on a new platform should contact IBM for a complete description of the Write Buffer command for this purpose. Note that new microcode may also be loaded without requiring the use of the SCSI Write Buffer command, by using the Field Microcode Replacement (FMR tape) process described in the maintenance information manual for this product. See “Magstar Drive Buffers” on page 135 for a list of the buffers supported by the drive. Table 87 shows the command format.

Table 87. Write Buffer Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'3B')							
1	Logical Unit Number			Reserved		Mode		
2	Buffer ID							
3	Buffer Offset							
4								
5								
6	Parameter List Length							
7								
8								
9	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- Modes:
  - Mode 1 (Vendor Unique) is supported.
  - Mode 5 (Download Microcode and Save) is supported.
  - Mode 6 (Download Microcode With Offsets) is supported
  - Mode 7 (Download Microcode With Offsets and Save) is supported.
- Buffer ID: The buffers supported in the 3590 drive are described in Table 34 on page 135.
- Buffer Offset: The 3590 drive defines the buffer offset field to be the address of the first location to be written by the current Write Buffer command, for both mode 1 and mode 5 of this command.
- Parameter List Length field: The number of bytes to be transferred for both mode 1 and mode 5.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Write Filemarks - X‘10’

The Write Filemarks command is supported by the 3590 drive. Table 88 shows the command format.

Table 88. Write Filemarks Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'10')							
1	Logical Unit Number			Reserved			WSmk	Immed
2	Transfer Length							
3								
4								
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- The WSmk (Write Setmark): B'0'
- Immed (Immediate):
  - B'0': present status when command is completed.
  - B'1': present status when command is verified.
- Transfer Length:

  Because the WSmk is set to B'0', the field indicates the number of filemarks to be written.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

After any buffered write operation completes, the initiator can issue a Write Filemarks command with the Immed bit set to B'0' and the Transfer Length set to X'000000' to ensure that all buffered data and filemarks are successfully written to the medium (synchronized).

Note: A tape may only be one format at a time. 3590 B-Series models write using B-Format (density code X'29') and E-Series models write using E-Format (density code X'2A'). At Beginning Of Tape, any tape written in one format can be changed to another format when a Write Filemarks command is issued. If an attempt is made by an E-series model to write a B-Format tape at any other location away from Beginning of Tape. CHECK CONDITION status is returned with associated sense data of 5/3005 (Illegal Request, Cannot Write Medium — Incompatible Format). Since a B-Series model cannot read an E-Format tape, this condition cannot happen on a B-Series model.

Chapter 3. ACF SCSI Commands

This chapter describes the SCSI commands supported for the 3590 ACF when addressed as an Independent Medium Changer device at LUN 1 (2-LUN addressing).

"Chapter 2. Drive SCSI Commands" on page 5 describes the SCSI commands supported for the 3590 drive (LUN 0). Those commands include support for the 3590 ACF when addressed as an Attached Medium Changer device at LUN 0 (1-LUN addressing).

Note: Attached Medium Changer (1-LUN addressing) is the default operating definition for all ACF modes of operation except Random 2-LUN (see "Change Definition -X'40'" on page 10).

The following SCSI command descriptions have a table describing the fields in the Command Descriptor Block (CDB), similar to the style used in the *ANSI Small Computer System Interface-2* standard. The descriptions following each CDB specify the options, values, and ranges for the fields described in the CDB as supported by the 3590 ACF. See section 7.2 in the *American National Standard Institute Small Computer System Interface X3T9.2/86-109 Revision 10h X3T39/89-042* standard for a description of the CDB and its fields.

© Copyright IBM Corp. 1996, 2000

ACF SCSI Commands Listed Alphabetically

Table 89 provides a list of all commands defined by the referenced SCSI-2 standard for medium changer devices. For each command, the operation code, reference page for this specification, applicable SCSI-2 standard section, type of support required for the command as defined by the SCSI standard, and applicability of certain conditions to the command are shown.

Table 89. 3590 ACF Commands (LUN 1)

Command Name	Operation Code	See Page	SCSI Document	Applicable Conditions: RVC[1] UAT NRD WRP MFC DCC
Change Definition	X'40'	NS	SPC	Y Y – – – –
Exchange Medium	X'A6'	NS	SMC	Y Y Y – – Y
Initialize Element Status	X'07'	192	SPC	Y Y Y – – Y
Inquiry	X'12'	193	SPC	– – – – – –
Log Select	X'4C'	NS	SPC	Y Y – – – –
Log Sense	X'4D'	196	SPC	Y – – – – –
Mode Select (6)	X'15'	197	SPC	Y Y – – – –
Mode Select (10)	X'55'	198	SPC	Y Y – – – –
Mode Sense (6)	X'1A'	199	SPC	– Y – – – –
Mode Sense (10)	X'5A'	200	SPC	– Y – – – –
Move Medium	X'A5'	126	SMC	Y Y Y – – Y
Position to Element	X'2B'	203	SMC	Y Y Y – – Y
Prevent Allow Medium Removal	X'1E'	NS	SPC	Y Y – – – –
Read Buffer	X'3C'	NS	SPC	Y – – – – –
Read Element Status	X'B8'	137	SMC	– Y Y – – –
Receive Diagnostic Results	X'1C'	213	SPC	Y Y – – – –
Release Element (6)	X'17'	214	SMC	–[2] Y – – – –
Request Sense	X'03'	151	SPC	– – – – – –
Request Volume Element Address	X'B5'	NS	SMC	Y Y – – – Y
Reserve Element (6)	X'16'	216	SMC	Y[3] Y – – – –
Rezero Unit	X'01'	NS	SMC	Y Y – – – –
Send Diagnostic	X'1D'	217	SPC	Y Y – – – –
Send Volume Tag	X'B6'	NS	SMC	Y Y – – – Y
Test Unit Ready	X'00'	184	SPC	Y Y Y – – Y[4]
Write Buffer	X'3B'	NS	SPC	Y Y – – – –

Table 89. 3590 ACF Commands (LUN 1) (continued)

Command Name	Operation Code	See Page	SCSI Document	Applicable Conditions: RVC[1] UAT NRD WRP MFC DCC

Legend:

M	Mandatory	RVC	Reservation Conflict status
O	Optional	UAT	CHECK CONDITION status for Unit Attention
-	Not Applicable	NRD	CHECK CONDITION status for Not Ready
NS	Not Supported	WRP	CHECK CONDITION status for Write Protected
		MFC	CHECK CONDITION status for Medium Format Corrupted
		DCC	Deferred CHECK CONDITION
		Y	Yes (Condition Applies)
		Y^n	Yes (Condition applies per note n below)

Notes:

1. If an I/O process consists of linked commands and begins with a command which is not subject to the RVC condition, subsequent commands in the I/O process are subject to Reservation Conflict status if the command is subject to the RVC condition and a reservation conflict exists.
2. Performs no operation if logical unit is reserved to another initiator.
3. Condition applies if logical unit is reserved to another initiator.
4. Reporting of deferred CHECK CONDITION status for the Test Unit Ready command is optional based on a vendor-unique field in the CDB.

Initialize Element Status - X‘07’

Table 90. Initialize Element Status Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'07')							
1	Logical Unit Number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Control							

The Initialize Element Status command is allowed and ignored for the 3590 ACF. The Read Element Status command will always cause the ACF to check all elements for media present and for any other status relevant to that element.

Inquiry - X‘12’

The Inquiry command supported by the ACF (LUN 1) is the same as the Inquiry command supported by the drive (LUN 0).

The Inquiry data returned by the ACF is different from the drive. There are several forms of Inquiry data. The following are supported and described in more detail as follows: There are several forms of Inquiry data. The following are supported and described in more detail as follows:

- B-Series and E-Series Models:
  - “Inquiry Standard Data: Valid LUN (Logical Unit Number)” on page 16
  - “Inquiry Standard Data: Invalid LUN” on page 19
  - “Inquiry Page X‘00’”
  - “Inquiry Page X‘03’: ASCII Information” on page 22
  - “Inquiry Page X‘80’: Unit Serial Number” on page 194
  - “Inquiry Page X‘83’: Device Identification” on page 194
- E-Series Models **Only**:
  - “Inquiry Page X'D0'” (the contents of this page are not specified in this document)

Refer to “Inquiry -X‘12’” on page 16 for a description of the Inquiry command.

Inquiry Page X‘00’

The following 3590-specific parameters apply to this request:

- EVPD (Enable Vital Product Data): B'1'
- Page Code: X'00'
- Allocation Length: X'09' bytes available
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

For a LUN that is associated with an installed device (see “SCSI-ID and LUN Assignments” on page 239), the following data is returned:

Byte	Description
0	Peripheral Data **Bit** **Description** **7-5** Peripheral Qualifier: B'000' **4-0** Peripheral Device Type: X'08'
1	Page Code: X'00'
2	Reserved
3	Page Length (n-3): X'05'
4	Supported Page: X'00'
5	Supported Page: X'03'
6	Supported Page: X'80'
7	Supported Page: X'83'
8	Supported Page: X'D0'

Inquiry Page X‘80’: Unit Serial Number

The following 3590-specific parameters apply to this request:

- EVPD (Enable Vital Product Data): B'1'
- Page Code: X'80'
- Allocation Length: X'10' (16) bytes available

For a LUN that is associated with an installed device (see “SCSI-ID and LUN Assignments” on page 239), the following data is returned:

Byte	Description
0	Peripheral Data

Bit	Description
7-5	Peripheral Qualifier: B'000'
4-0	Peripheral Device Type: X'01' or X'08'

1	Page Code: X'80'
2	Reserved
3	Page Length: X'0C'
4-15	Serial Number of device, right-justified with leading zeroes, in ASCII (same as Inquiry Standard Data bytes 38–49)

Inquiry Page X‘83’: Device Identification

The following 3590-specific parameters apply to this request:

- EVPD (Enable Vital Product Data): B'1'
- Page Code: X'83'
- Allocation Length: X'30' (48) bytes available

For a LUN that is associated with an installed device (see “SCSI-ID and LUN Assignments” on page 239), the following data is returned:

Byte	Description
0	Peripheral Data

Bit	Description
7-5	Peripheral Qualifier: B'000'
4-0	Peripheral Device Type: X'08'

1	Page Code: X'83'
2	Reserved
3	Page Length: X'2C'
	Identifier Descriptor
4	

Bit	Description
7-4	Reserved
3-0	Code Set: X'2' (Identifier is all ASCII)

5

Bit	Description
7-6	Reserved
5-4	Association: B'00'
3-0	Identifier Type: X'1'

6 Reserved

7 Identifier Length: X'28'

8-15 Vendor ID (same as Inquiry Standard Data bytes 8–15)

16-31 Device Type and Model Number (same as Inquiry Standard Data bytes 16–31)

32-43 Serial Number of device, right justified with leading zeroes, in ASCII (same as Inquiry Standard Data bytes 38–49)

44-47 First Storage Element Address (ASCII representation of 4 hexidecimal digits from Mode Page X'ID' bytes 6–7)

Bytes 48-59 are returned only on Fibre Channel attached devices.

48

Bit	Description
7-4	Reserved
3-0	Code Set: X'1'

49

Bit	Description
7-6	Reserved
5-4	Association Type: B'00'
3-0	Identifier Type: X'3'

50 Reserved

51 Identifier Length: X'08'

52

Bit	Description
7-4	Name Format: B'0101'
3-0	OUI Format Identifier

53-54 OUI Format Identifier (continued)

55

Bit	Description
7-4	OUI Format Identifier (continued)
3-0	Vendor Specified Identifier

56 Vendor Specified Identifier (continued)

57

Bit	Description
7-6	Port/Node ID: B'11'
5-0	Serial Number

58-59 Serial Number (continued)

Log Sense - X‘4D’

The Log Sense command supported by the ACF (LUN 1) is the same as the Log Sense command supported by the drive (LUN 0).

The log pages supported for the 3590 ACF Log Sense command are:

- “Log Page ‘00’: Supported Log Pages”
- “Log Page X‘31’: SIM/MIM” on page 43

The parameter code byte is the same for the ACF as for the drive.

Refer to “Log Sense -X‘4D’” on page 32 for a description of the Log Sense command.

Log Page ‘00’: Supported Log Pages

This log page returns the list of log pages supported by the 3590 ACF.

Byte	Description
0	

Bit	Description
7-6	Reserved
5-0	Page Code (B'000000')

1	Reserved
2-3	Page Length (X'0002')
4	Supported Log Pages (X'00')
5	SIM/MIM page (X'31')

Mode Select (6) - X‘15’

The Mode Select (6) command supported by the ACF (LUN 1) is the same as the Mode Select (6) command supported by the drive (LUN 0).

The mode pages supported by the 3590 ACF are:

- “Mode Page X‘0A’: Control Mode” on page 96
- “Mode Page X‘1D’: Element Address Assignment” on page 106
- “Mode Page X‘1E’: Transport Geometry Parameters” on page 107
- “Mode Page X‘1F’: Device Capabilities” on page 108
- “Mode Page X‘20’: ACF (Loader) Control” on page 110

Refer to “Mode Select (6) - X‘15’” on page 74 for a description of the Mode Select (6) command.

Mode Parameter Header for Mode Select (6)

The Mode Pages for the Mode Select (6) command are preceded by a four byte Mode Parameter Header.

There is one copy of this header for each initiator.

Byte	Description
0	Mode Data Length: X'00' This field is reserved when used with the Mode Select (6) command. (When used with the Mode Sense commands, this field specifies the length in bytes of the following data that is available to be transferred. The length field does not include itself.)
1	Medium Type: X'00' This field is reserved on Medium Changer Devices.
2	Device-Specific Parameter: X'00' This field is reserved on Medium Changer Devices.
3	Block Descriptor Length: X'00' Block descriptors are not used on the 3590 ACF.

Mode Select (10) - X‘55’

The Mode Select (10) command supported by the ACF (LUN 1) is the same as the Mode Select (10) command supported by the drive (LUN 0).

The mode pages supported by the 3590 ACF are:

- “Mode Page X‘0A’: Control Mode” on page 96
- “Mode Page X‘1D’: Element Address Assignment” on page 106
- “Mode Page X‘1E’: Transport Geometry Parameters” on page 107
- “Mode Page X‘1F’: Device Capabilities” on page 108
- “Mode Page X‘20’: ACF (Loader) Control” on page 110

Refer to “Mode Select (10) - X‘55’” on page 79 for a description of the Mode Select (10) command.

Mode Parameter Header for Mode Select (10)

The Mode Pages for the Mode Select (10) command are preceded by an eight-byte Mode Parameter Header.

There is one copy of this header for each initiator.

Byte	Description
0-1	Mode Data Length: X'0000' This field is reserved when used with the Mode Select (10) command. (When used with the Mode Sense commands, this field specifies the length in bytes of the following data that is available to be transferred. The length field does not include itself.)
2	Medium Type: X'00' This field is reserved on Medium Changer Devices.
3	Device-Specific Parameter: X'00' This field is reserved on Medium Changer Devices.
4-5	Reserved
6-7	Block Descriptor Length: X'0000' Block descriptors are not used on the 3590 ACF.

Mode Sense (6) - X‘1A’

The Mode Sense (6) command supported by the ACF (LUN 1) is the same as the Mode Sense (6) command supported by the drive (LUN 0).

The mode pages supported by the 3590 ACF are:

- “Mode Page X‘0A’: Control Mode” on page 96
- “Mode Page X‘1D’: Element Address Assignment” on page 106
- “Mode Page X‘1E’: Transport Geometry Parameters” on page 107
- “Mode Page X‘1F’: Device Capabilities” on page 108
- “Mode Page X‘20’: ACF (Loader) Control” on page 110

Refer to “Mode Sense (6) - X‘1A’” on page 83 for a description of the Mode Select (6) command.

Mode Parameter Header for Mode Sense (6)

The Mode Pages for the Mode Sense (6) command are preceded by a four byte Mode Parameter Header.

There is one copy of this header for each initiator.

Byte	Description
0	Mode Data Length: When used with the Mode Sense commands, this field specifies the length in bytes of the following data that is available to be transferred. The length field does not include itself. (This field is reserved when used with the Mode Select (6) command.)
1	Medium Type: X'00' This field is reserved on Medium Changer Devices.
2	Device-Specific Parameter: X'00' This field is reserved on Medium Changer Devices.
3	Block Descriptor Length: X'00' Block descriptors are not used on the 3590 ACF.

Mode Sense (10) - X‘5A’

The Mode Sense (10) command supported by the ACF (LUN 1) is the same as the Mode Sense (10) command supported by the drive (LUN 0).

The mode pages supported by the 3590 ACF are:

- “Mode Page X‘0A’: Control Mode” on page 96
- “Mode Page X‘1D’: Element Address Assignment” on page 106
- “Mode Page X‘1E’: Transport Geometry Parameters” on page 107
- “Mode Page X‘1F’: Device Capabilities” on page 108
- “Mode Page X‘20’: ACF (Loader) Control” on page 110

Refer to “Mode Sense (10) - X‘5A’” on page 88 for a description of the Mode Select (10) command.

Mode Parameter Header for Mode Sense (10)

The Mode Pages for the Mode Sense (10) command are preceded by an eight-byte Mode Parameter Header.

There is one copy of this header for each initiator.

Byte	Description
0-1	Mode Data Length: When used with the Mode Sense commands, this field specifies the length in bytes of the following data that is available to be transferred. The length field does not include itself. (This field is reserved when used with the Mode Select (6) command.)
2	Medium Type: X'00' This field is reserved on Medium Changer Devices.
3	Device-Specific Parameter: X'00' This field is reserved on Medium Changer Devices.
4-5	Reserved
6-7	Block Descriptor Length: X'0000' Block descriptors are not used on the 3590 ACF.

Mode Page Format

"Mode Page Format" on page 92 shows the format of the mode parameter list. The individual mode page descriptions that follow this table include the field descriptions.

Move Medium -X‘A5’

The Move Medium Command is supported by LUN 0 of the drive only on B-Series models and then only when operating as an Attached Medium Changer.

The Move Medium command supported by the drive (LUN 0) is the same as the Move Medium command supported by the ACF (LUN 1).

Table 91 shows the command format.

Table 91. Move Medium Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'A5')							
1	Logical Unit Number			Reserved				
2	Transport Element Address							
3								
4	Source Address							
5								
6	Destination Address							
7								
8	Reserved							
9	Reserved							
10	Reserved							Invert
11	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- Transport Element Address: X'0000' (Or X'0001', which instructs the ACF to choose the Medium Transport. Because there is only one, either address gets the same results.)
- Source Addresses:
  - Data Transfer Element (device) — X'0010'
  - Import Export Element (Priority Cell) — X'001F'
  - Storage Elements (Magazine cells — top to bottom) - X'(0020-0029)'
- Destination Addresses:
  - Data Transfer Element (device) — X'0010'
  - Import Export Element (Priority Cell) — X'001F'
  - Storage Elements (Magazine cells — top to bottom) - X'(0020-0029)'

  Note: The Medium Transport Element (element address X'0000') is not capable of storing a media element. If this element address is specified as a Source or Destination Address in a Move Medium command, the command is presented CHECK CONDITION status with associated sense data of 5/2101 (Illegal Request, Invalid Element Address).
- Invert: B'0'
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

For additional information on element addresses and descriptions, see “Mode Page X‘1D’: Element Address Assignment” on page 106, “Mode Page X‘1F’: Device Capabilities” on page 108, and “Read Element Status - X‘B8’” on page 137.

Position to Element - X‘2B’

Table 92. Position to Element Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'2B')							
1	Logical Unit Number			Reserved				
2	Transport Element Address							
3								
2	Destination Element Address							
3								
6	Reserved							
7	Reserved							
8	Reserved							Invert
9	Control							

This command is allowed and ignored. The 3590 ACF returns GOOD status.

Read Element Status - X‘B8’

The Read Element Status Command is supported by LUN 0 of the drive only on B-Series models and then only when operating as an Attached Medium Changer.

The Read Element Status command supported by the drive (LUN 0) is the same as the Read Element Status command supported by the ACF (LUN 1).

The Read Element Status command is supported by LUN 0 of the 3590 drive when operating as an Attached Medium Changer.

This command is only accepted by 3590 ACF models when the ACF is in Random or Random 2-LUN mode. If this command is received while the ACF is not in Random or Random 2-LUN mode, the device will return CHECK CONDITION status with the associated sense data of 2/0403 (Not Ready, Logical Unit Not Ready - Manual Intervention Required). Table 93 shows the command format.

Table 93. Read Element Status Command

Bit Byte	**7 MSB**	**6**	**5**	**4**	**3**	**2**	**1**	**0 LSB**
0	Operation code (X'B8')							
1	Logical Unit Number			VolTag	Element Type Code			
2	Starting Element Address							
3								
4	Number of Elements							
5								
6	Reserved						CURDATA	DVCID
7	Allocation Length							
8								
9								
10	Reserved							
11	Vendor Specific (B'00')		Reserved (B'0000')				Flag	Link

The following 3590-specific parameters apply:

- VolTag (Volume Tags): B'0'

  The VolTag field is not supported by the 3590 device.
- DVCID
  - B'0': Requests the library to report status for the element(s) indicated in the Element Type Code field.
  - B'1': Requests the library to report device identifiers, if available, for the Data Transfer Elements.
- CURDATA
  - B'0': Motion is allowed as needed in order to return a maximum set of valid element status data.
  - B'1': Motion is not allowed — a minimum set of valid data may be returned. This field is supported for SCSI-3 compliance, but it is not required to be set to B'1' in order to obtain the Device IDs for the Data Transfer Elements. All other data will be returned as invalid with an ASC/ASCQ in each element descriptor set to 81/00 (Status is Questionable).

- Element Type Code:

Value	Description
X'0'	Report all element types
X'1'	Report Medium Transport Elements only
X'2'	Report Storage Elements only
X'3'	Report Import/Export Elements only
X'4'	Report Data Transfer Elements only

- Starting Element Address is the minimum element address to report.
- Number of Elements is the maximum number of elements to be included in this report.
- Allocation Length is the maximum number of bytes of data to be returned for this report.
- See “Control Byte Definition” on page 9 for Flag and Link bit descriptions.

Element Status Data

This data is a header that precedes the specific element type information, if any. Following this data are zero or more Element Status Pages, up to one for each of the four Element Types supported, if the command permits. Following each Element Status Page are zero or more Element Descriptors, up to one Element Descriptor for each element cell of that element type in the ACF, again if the data in the CDB permits.

Byte	Description
0-1	First Element Address Reported: The smallest element address found to meet the CDB request. For the 3590 ACF, the lowest value is X'0000' and the highest value is X'0029'.
2-3	Number of Elements The number of elements meeting the request in the CDB. For the 3590 ACF, the lowest value is X'0000' and the highest value is X'000D'.
4	Reserved
5-7	Byte Count of Report Available

Element Status Page

There is one status page for each of the element types to be reported.

Byte	Description
0	Element Type Code Indicates the element type reported by this page. (The Element Type Codes allowed for the Element Status Page are 1, 2, 3, and 4; 0 is allowed for the CDB only.)
1	Tag Byte **Bit** **Description** **7** PVolTag (Primary Volume Tag): B'0' The 3590 device does not support PVolTag. **6** AVolTag (Alternate Volume Tag): B'0' The 3590 device does not support AVolTag. **5-0** Reserved
2-3	Element Descriptor Length: X'000C'

The length of each type of Element Descriptors. For the 3590 device, the Element Descriptor Length is the same for all four element types.

4 Reserved

5-7 Byte Count of Descriptor Data Available

The number of bytes of element descriptor data available for elements of this element type meeting the request in the CDB.

Element Descriptors

For each Element Type, there is a set of Element Descriptors, one descriptor for each element in the ACF of that Element Type, up to the limit imposed by the CDB. These pages are described below.

Element Type 1:
Medium Transport Element Descriptor

This is the element associated with the transport mechanism. Cartridges are never stored in the transport mechanism.

Byte **Descriptor**

0-1 Element Address: X'0000'

The element address field gives the address of the medium changer element whose status is reported by this element descriptor block. There is only one medium transport element in the ACF.

2

Bit	Description
7-3	Reserved
2	Except • B'0': The transport is in a normal state. • B'1': The transport is in an abnormal state.
1	Reserved
0	Full • B'0': The transport does not contain a cartridge. • B'1': The transport contains a cartridge. A value of B'1' is a transient event because it is not a destination for a cartridge.

3 Reserved

4-5 Additional Sense Code (ASC)/Additional Sense Code Qualifier (ASCQ): X'0000'

6-8 Reserved

9

Bit	Description
7	SValid: B'0' • B'0': Indicates that the Source Storage Element Address field is not valid. The 3590 device does not support Source Storage Element Address for this element.
6	Invert: B'0' The 3590 ACF does not invert cartridges.
5-0	Reserved

10-11 Source Storage Element Address: X'0000'

This field provides the address of the last storage element from which this cartridge was moved. The 3590 device does not support Source Storage Element Address for this element.

Element Type 2:
Storage Element Descriptor

This is the element used for storage of the cartridges. For the 3590 ACF, these elements are located in the magazines and do not include the priority cell position.

Byte **Descriptor**

0-1 Element Address:

The element address field gives the address of the storage element whose status is reported by this element descriptor block. The range of addresses for the 3590 ACF are X'0020-0029'.

2

Bit	Description
7-4	Reserved
3	Access • B'0': Indicates that access to the storage element by a medium transport element is denied. • B'1': Indicates that access to the storage element by a medium transport element is allowed. **Note:** An example of when access would be denied is when the magazine cell has a cartridge in the Export position.
2	Except • B'0': The element is in a normal state. • B'1': The element is in an abnormal state.
1	Reserved
0	Full • B'0': The element does not contain a cartridge. • B'1': The element cell contains a cartridge.

3 Reserved

4-5 Additional Sense Code (ASC)/Additional Sense Code Qualifier (ASCQ): X'0000'

6-8 Reserved

9

Bit	Description
7	SValid: B'0' • B'0': Indicates that the Source Storage Element Address field is not valid. The 3590 device does not support Source Storage Element Address for this element.
6	Invert: B'0' The 3590 ACF does not invert cartridges.
5-0	Reserved

10-11 Source Storage Element Address: X'0000'

This field provides the address of the last storage element from which this cartridge was moved. The 3590 device does not support Source Storage Element Address for this element.

Element Type 3:
Import/Export Element Descriptor

This is the element used for moving volumes into and out of the medium changer. In the 3590 ACF, this element is also known as the Priority Cell.

Byte **Descriptor**

0-1 Element Address:

The element address field gives the address of the element whose status is reported by this element descriptor block. The address for the Import/Export Element is X'001F'.

2

Bit	Description
7-6	Reserved
5	InEnab (Import Enable): B'1' InEnab indicates that this element supports movement of media into the scope of the ACF.
4	ExEnab (Export Enable): B'1' ExEnab indicates that this element supports movement of media out of the scope of the ACF.
3	Access • B'0': Indicates that access to the Import/Export element by a medium transport element is denied. • B'1': Indicates that access to the Import/Export element by a medium transport element is allowed. **Note:** An example of when access would be denied is when the Import/Export cell already has a cartridge in the Export position.
2	Except • B'0': The element is in a normal state. • B'1': The element is in an abnormal state.
1	Reserved
0	Full • B'0': The element does not contain a cartridge. • B'1': The element cell contains a cartridge.

3 Reserved

4-5 Additional Sense Code (ASC)/Additional Sense Code Qualifier (ASCQ): X'0000'

6-8 Reserved

9

Bit	Description
7	SValid: B'0' • B'0': Indicates that the Source Storage Element Address field is not valid. The 3590 device does not support Source Storage Element Address for this element.
6	Invert: B'0' The 3590 ACF does not invert cartridges.
5-0	Reserved

10-11 Source Storage Element Address: X'0000'

This field provides the address of the last storage element from which this cartridge was moved. The 3590 device does not support Source Storage Element Address for this element.

Element Type 4:
Data Transfer Element Descriptor (DVCID = B'0')

This is the element descriptor block used to report the status of the drive.

Byte **Descriptor**

0-1 Element Address:

The element address field gives the address of the element whose status is reported by this element descriptor block. The address for the Data Transfer Element is X'0010'.

2

Bit	Description
7-4	Reserved
3	Access • B'0': Indicates that access to the Data Transfer element by a medium transport element is denied. • B'1': Indicates that access to the Data Transfer element by a medium transport element is allowed.
2	Except • B'0': The element is in a normal state. • B'1': The element is in an abnormal state.
1	Reserved
0	Full • B'0': The element does not contain a cartridge. • B'1': The element contains a cartridge in a loaded or ejected position.

Note: A cartridge in the loaded position is indicated by the Full bit set to B'1' and the Access bit set to B'0'. A cartridge in the ejected position is indicated by the Full bit set to B'1' and the Access bit set to B'1'.

3 Reserved

4-5 Additional Sense Code (ASC)/Additional Sense Code Qualifier (ASCQ): X'0000'

6

Bit	Description
7	Not Bus (Not this Bus): B'0' Indicates that the SCSI address and LU values are on the same bus as the medium changer device.
6	Reserved
5	ID Valid: B'1' ID Valid indicates that the SCSI bus address field contains valid information.
4	LU Valid: B'1' Logical Unit Valid indicates that the Logical Unit Number field contains valid information.
3	Reserved
2-0	Logical Unit Number: B'000' The LUN is always zero.

7 SCSI bus address

Set to the SCSI ID of the drive.

8 Reserved

9

Bit	Description
7	SValid • B'0': Indicates that the Source Storage Element Address field is not valid. • B'1': Indicates that the Source Storage Element Address field is valid.
6	Invert: B'0' The 3590 ACF does not invert cartridges.
5-0	Reserved

10-11 Source Storage Element Address

When SValid is B'1', this field provides the address of the last storage element from which this cartridge was moved.

Element Type 4:
Data Transfer Element Descriptor (DVCID = B'1')

This is the element descriptor block used to report the status of the drive(s).

Byte **Descriptor**

0-1 Element Address

2

Bit	Description
7-4	Reserved
3	Access: B'0' (Not supported when DVCID=B'1')
2	Except: B'' (Always set when DVCID=B'1')
1	Reserved
0	Full: B'0' (Not supported when DVCID=B'1')

3 Reserved

4-5 Additional Sense Code (ASC)/Additional Sense Code Qualifier (ASCQ): X'8100'

Status is Questionable, Drive is Present

6

Bit	Description
7	Not Bus (Not this Bus): B'0'
6	Reserved
5	ID Valid: B'0' (Not supported when DVCID=B'1')
4	LU Valid: B'0' (Not supported when DVCID=B'1')
3	Reserved
2-0	Logical Unit Number: B'000'

7 SCSI bus address: X'00'

8 Reserved

9

Bit	Description
7	SValid: B'0' (Not supported when DVCID=B'1')
6	Invert: B'0'
5-0	Reserved

10-11 Source Storage Element Address: X'0000'

Identification Descriptor (same as Drive Inquiry Page X'83', bytes 4–43)

12

Bit	Description
7-4	Reserved
3-0	Code Set: X'2' (Identifier is all ASCII)

13

Bit	Description
7-6	Reserved
5-4	Association: B'00'
3-0	Identifier Type: X'1'

14 Reserved

15 Length of Device Identifier: X'24'

16-23 Vendor ID

24-39 Device Type and Model Number

40-51 Serial Number of device, right justified with leading zeroes, in ASCII

Receive Diagnostic Results - X‘1C’

The Receive Diagnostic Results command supported by the ACF (LUN 1) is the same as the Receive Diagnostic Results command supported by the drive (LUN 0).

The only Diagnostic ID supported by the 3590 ACF is X'0102', ACF Diagnostic (see “Magstar-Supported Diagnostics” on page 162).

Refer to “Receive Diagnostic Results - X‘1C’” on page 143 for a description of the Receive Diagnostic Results command.

Release Element (6) - X‘17’

The Release Element (6) command supported by the ACF (LUN 1) differs from the Release Unit command supported by the drive (LUN 0) in that the ACF supports the ability to release elements, where the drive does not.

Table 94. Release Element (6) Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'17')							
1	Logical Unit Number			3rdPty	Third Party Device ID			Element
2	Reservation Identification							
3	Reserved							
4	Reserved							
5	Control							

The following 3590 specific parameters apply:

- The 3rdPty (Third Party) release is not supported by the 3590 ACF.
- The Third Party Device ID is not supported by the 3590 ACF.
- Element:
  - B'0': The device and any reserved elements are released from any reservation by this initiator.
  - B'1': The reservation from the requesting initiator with a matching reservation identification is terminated. Other reservations from the requesting initiator shall remain in effect.
- Reservation Identification

  Identifies the reservation list to be released. The particular reservation list identified must be owned by the requesting initiator.

Request Sense - X‘03’

The Request Sense command supported by the ACF (LUN 1) is the same as the Request Sense command supported by the drive (LUN 0).

When acting as an Independent Medium Changer, the device only returns sense data related to the LUN which has been specified.

Refer to “Request Sense - X‘03’” on page 151 for a description of the Request Sense command.

Reserve Element (6)- X‘16’

The Reserve Element (6) command supported by the ACF (LUN 1) differs from the Reserve Unit command supported by the drive (LUN 0) in that the ACF supports the ability to reserve elements, where the drive does not.

Table 95. Reserve Command

Bit Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Operation code (X'16')							
1	Logical Unit Number			3rdPty	Third Party Device ID			Element
2	Reservation Identification							
3-4	Element List Length							
5	Control							

The following 3590-specific parameters apply:

- The 3rdPty (Third Party) reserve is not supported by the 3590 ACF.
- Third Party Device ID is not supported.
- Element
  - B'0': this command requests that the entire device be reserved for the exclusive use of the initiator making the request.
  - B'1': this command requests that the elements in the element list be reserved for the exclusive use of the initiator making the request.
- Reservation Identification

  This field allows the initiator to assign a specific value to a list of element descriptors. Multiple reservation IDs are permitted.
- Element List Length

  Contains the size of the element list. Values must be 0, 6, or multiples of 6.

Data Format of Element List Descriptors

The element list shall consist of zero or more descriptors. Each element list descriptor defines a series of elements beginning at the specified element address for the specified number of elements.

Byte **Description**

0-1 Reserved

2-3 Number of Elements

Specifies the number of elements included in this descriptor. If the number of elements is zero, the element list shall begin at the specified element address and continue through the last element address on the device.

4-5 Element Address

The beginning element address for this descriptor.

Send Diagnostic - X‘1D’

The Send Diagnostic command supported by the ACF (LUN 1) is the same as the Send Diagnostic command supported by the drive (LUN 0).

The only Diagnostic ID supported by the 3590 ACF is X'0102', ACF Diagnostic (see “Magstar-Supported Diagnostics” on page 162).

Refer to “Send Diagnostic - X‘1D’” on page 160 for a description of the Send Diagnostic command.

Test Unit Ready - X‘00’

The Test Unit Ready command supported by the ACF (LUN 1) is the same as the Test Unit Ready command supported by the drive (LUN 0).

Refer to “Test Unit Ready - X‘00’” on page 184 for a description of the Test Unit Ready command.

Chapter 4. ACF Modes of Operation

The ACF has 7 modes of operation: Manual, Automatic, System, Accumulate, Random, and Random 2-LUN. The operator can choose all the modes.

Each mode and their operations are described in the following list:

Manual
Cartridge is fed to the drive loader individually each time.

Accumulate
Cartridge is put in the priority cell and output into the magazine.

Automatic
Cartridges that are put into the magazine are automatically fed into the drive loader one after another until the entire magazine is processed.

System
Cartridges that are put into the magazine are fed to the drive loader one after another under the attaching system's command until the entire magazine is processed. Note that not all attaching hosts support System mode.

Random
Operates as a small library. All cartridge moves are made under the attaching system's commands. Cartridges may be accessed and re-accessed in any order. For E-Series Models, Random Mode operates as a SCSI Independent Media Changer.

Random 2-LUN
Same as Random Mode, except operates as a SCSI Independent Medium Changer (2-LUN addressing) rather than a SCSI Attached Medium Changer (1-LUN addressing). This Mode is not available on E-Series Modles since Random Mode operates as an Independent Media Changer already in Random Mode.

ACF Notes

These items are general in nature and cover many or all modes. Rather than repeating these notes in each mode description, the notes are shown here and referenced from the mode descriptions.

1. When the magazine is removed from the ACF, it is automatically locked.

   When the magazine is placed in the ACF, it is automatically unlocked. If ACF Random or Random 2-LUN mode is to be used, the operator must press the magazine lock button.
2. In Random or Random 2-LUN mode, a cartridge that is returned to the magazine is placed in the import position, to be available for reuse by the attaching host.
3. In Manual, Automatic, Accumulate, and System mode, a cartridge returned to the magazine is placed in the export position.
4. To reuse a cartridge exported in the priority cell (in all modes), either remove and re-insert the cartridge or push the cartridge back to the import position and select Start on the Operator Panel.
5. The feed mechanism for the ACF can access cartridges only in the import position.

© Copyright IBM Corp. 1996, 2000

6. If the ACF is disabled, the operator presses Start on the operator panel, and there is no magazine in the ACF or there is no cartridge in the import position in either the magazine or in the priority cell, the ACF returns to the disabled state without changing the position of any cartridge. This does not constitute an error and no error status is returned.
7. If while unloading a cartridge to the magazine, the destination cell is occupied, the ACF tries to unload the cartridge to the priority cell (also see Note 9).
8. If the ACF is instructed to unload a cartridge to the magazine and the magazine is not installed, the ACF tries to unload the cartridge to the priority cell (also see Note 9). The cell-status indicator is set to alert (solid yellow) for the priority cell.
9. If the ACF tries to unload the cartridge to the priority cell (in any mode other than Random or Random 2-LUN) and the priority cell is occupied, the ACF sets the cell status indicator to attention (flashing yellow) on all cells and disables the ACF (extra cartridge condition). The ACF causes CHECK-CONDITION status to be returned with associated sense data of 5/3B0D (Illegal Request, Medium Destination Element Full). In Random or Random 2-LUN mode, a Move Medium command specifying the priority cell as a target will cause CHECK CONDITION status to be returned with associated sense data of 5/3B0D (Illegal Request, Medium Destination Element Full) if the priority cell is already occupied.

   For any mode other than Random or Random 2-LUN, when the cartridge occupying the priority cell is removed (by the operator in most modes), the ACF will automatically transfer the previously blocked cartridge to the priority cell in export position without further operator intervention. The associated cell status information is reset.

Initiator Control of the ACF

When the ACF operates in Manual, Accumulate, or Automatic mode, the initiator controls only the unload of the cartridge from the device; it does not issue any command that causes the ACF to load a cartridge. A Load Unload command that requests an unload operation causes a cartridge to be unloaded. See also “ACF Notes” on page 219.

If a Load/Unload command with the ‘load’ bit set is received while the ACF is enabled in System mode, the ACF loads a cartridge. If a Load Unload command with the ‘load’ bit set is received in any mode other than System mode, the command is presented CHECK-CONDITION status with associated sense data of 2/0400 (Not Ready, Logical Unit Not Ready, Cause Not Reportable). Receiving two Load Unload commands with the ‘load’ bit set and without an intervening unload also causes the same check condition. If no ACF is present and a cartridge was unloaded but not removed, the Load Unload command is accepted with the Load bit set to 1.

When the ACF operates in System mode, the program has indirect control over the ACF. The program specifies that a cartridge is to be loaded if possible, but cannot specify from which cell the cartridge is to be obtained. If no magazine is found and the priority cell is empty, the command is presented CHECK CONDITION status with associated sense data of 2/3A00 (Not Ready, No Medium Present). If a magazine is present, but contains no cartridges that can be loaded and the priority cell is also empty, the command is presented CHECK CONDITION status with associated sense data of 5/3B0E (Illegal Request, Medium Source Element Empty).

When the ACF operates in Random or Random 2-LUN mode, the program can control the ACF through the Prevent Allow Medium Removal, Read Element Status, and Move Medium commands. These commands allow the ACF to access cartridges from cells that are located nonsequentially, to assist the initiator in generating and maintaining an inventory of the cartridges in the magazine, and to indicate to the operator that these cartridges can be removed.

The physical implementation for most modes can be viewed as a medium changer with 11 import and export ports, no storage elements, a single data transfer element, and a single medium transport element that cannot be used to permanently store a piece of medium. Random and Random 2-LUN modes have a different configuration.

For Random or Random 2-LUN mode, the ACF contains one import and export port, 10 storage elements, a single data-transfer element and a single medium-transport element. The program should issue the Read Element Status command when changing ACF modes to assure the correct configuration.

In Random and Random 2-LUN modes, an exported medium can be imported again from the magazine.

Manual Mode

Manual mode allows the operator to load a cartridge by operator action. Each time the operator presses Start, the ACF selects a cartridge from the appropriate cell and mounts it in the device. Only one cartridge is loaded for each operator action.

Terminology Note: *Initial Conditions* refers to actions the operator or attaching host must take prior to attempting to initiate ACF activity. *Enabling Conditions* refers to the actions that begin ACF motion. Similarly *Disabling Conditions* refers to the actions that stop ACF activity.

When the ACF is operating in Manual mode, the following applies (see also “ACF Notes” on page 219):

- Initial condition:
  - Manual mode must be selected from the Select ACF Mode menu at the operator panel.

    Note: When the ACF enters Manual mode from any other mode, the medium changer (‘mchngr’) bit in Inquiry data is set to 0 and the ACF mode in Mode Page X'20' is set to Manual.
- Enabling conditions: Two way to enable Manual mode
  - Insert a cartridge into the import position of the priority cell
  - Press Start if there is a loadable cartridge in the magazine.
- Disabling conditions: The ACF becomes disabled in Manual mode when:
  - The magazine cartridge was processed and returned to its original cell and there is no cartridge in the import position of the priority cell.
  - The ACF is enabled from the operator choosing Start, but the ACF cannot detect a cartridge in the import position in the magazine.
  - An attention condition is detected in the ACF; for example, an extra cartridge condition.

  - The magazine is not installed, choosing Start causes the ACF to return to the disabled state.
- Operation
  1. If the ACF is disabled and in Manual mode, and the operator chooses Start on the operator panel, the ACF becomes enabled and then verifies that at least one cartridge is in the import position of the magazine. If so, the ACF indexes down the magazine until it finds the first cell with a cartridge in the import position. The ACF sets the cell-status indicator for that cell to in-use (steady green) and moves the cartridge from the cell to the device.
  2. If the ACF is disabled and in Manual mode, and a cartridge is placed in the import position of the priority cell, the ACF loads the cartridge in the device and sets the cell-status indicator to in-use (steady green) for the priority cell.
  3. If a cartridge is placed in the priority cell while the ACF is enabled and in Manual mode, the ACF sets the cell-status indicator of the priority cell to in-use (steady green). When the ACF completes its current operation, the ACF automatically loads the priority cell as described in step 2.
  4. When a cartridge that was loaded while in Manual mode is unloaded, it is returned to its original cell if possible, and the in-use indication is turned off. If the original cell is occupied, the ACF turns off the in-use indicator and puts the cartridge in the priority cell, if possible, and sets the priority cell status indicator to alert (steady yellow). If the priority cell is occupied, the ACF is disabled and it presents check status (see step 9 on page 220). The cell-status indicators for all cells are set to attention (flashing yellow). An intervention message is posted on the operator panel.
- Cleaning the drive in Manual mode:

  To clean the drive when the ACF is in Manual mode, place a cleaning cartridge in the priority cell. The cleaning cartridge is automatically loaded, completes its cleaning, and is unloaded into the priority cell again. To determine when cleaning is required, see “Drive Cleaning Indicators” on page 242.

Accumulate Mode

Some customers organize their operations so that certain ßs focus on specific cartridge mounts; that is, the entire device is dedicated to responding to servicing specific volumes requested by the initiator. For this type of operation, the customer needs the ability to easily insert specific cartridges and the ability to allow processed specific mount to accumulate in a *hopper* until it is convenient for the operator to retrieve a group of cartridges.

In Manual, Automatic, and System mode, cartridges are always exported to the same ACF cell from which they were imported, if possible. This makes them convenient for processing scratch volumes. Accumulate mode differs in that cartridges are always imported from the priority cell, and exported to a magazine cell. This allows the operator to insert specific cartridges into the priority cell, and to accumulate processed cartridges into the magazine for pickup by the operator.

When the ACF is in Accumulate mode, the following applies (see also “ACF Notes” on page 219):

- Initial conditions
  - Accumulate mode must be selected from the Select ACF Mode menu at the operator panel.

Note: When the ACF enters Accumulate mode from any other mode, the medium changer (mchngr) bit in Inquiry data is set to zero and the ACF mode in Mode Page X'20' is set to Accumulate.

  - While not a required condition, we recommend that initially the magazine be empty.
  - To indicate to the operator that they should not place cartridges in the magazine (only remove cartridges), all magazine cells have the cell-status indicators set to in-use (steady green). This is to remind the operator that the entire magazine is reserved as the accumulate *hopper*.

- Enabling condition: To enable Accumulate mode
  - Insert a cartridge into the import position of the priority cell.
- Disabling conditions: The ACF becomes disabled in Accumulate mode as follows:
  - The magazine is full and the last imported cartridge is returned to the priority cell.
  - An attention condition is detected in the ACF; for example, an extra cartridge condition.
- Operation:
  1. If the ACF is disabled and in Accumulate mode, the ACF becomes enabled when a cartridge is inserted in the import position of the priority cell.
  2. When a cartridge is inserted into the priority cell, the cartridge sets the cell-status indicator to in-use (steady green) for the priority cell and waits for the device to become available.
  3. When the device is available, the cartridge is loaded in the device and the priority cell indicator is turned off.
  4. When a cartridge is unloaded from the drive, it is moved to the magazine. The ACF places the cartridge in the top cell of the magazine unless that cell is occupied. If the top cell is occupied, the ACF searches down the magazine for the next available cell. Each cartridge is placed in the export position.
  5. When the last available cell in the magazine is filled, the ACF warns the operator by activating all magazine cell-status indicators to alert (steady yellow). If another cartridge is unloaded, it is placed into the priority cell again, if possible, and the priority cell indicator is set to alert (steady yellow). See step 9 on page 220 if the priority cell is also full.
- Cleaning the drive in Accumulate mode:

  To clean the drive when the ACF is in Accumulate mode, place a cleaning cartridge in the priority cell. The cleaning cartridge is automatically loaded, completes its cleaning, and is unloaded into the next available magazine cell. If no magazine cell is available, the cartridge is returned to the priority cell. To determine when cleaning is required, see “Drive Cleaning Indicators” on page 242.

Automatic Mode

Automatic mode provides the operator a mechanism to keep the drive continually fed with cartridges from the magazine. After enabling the ACF, is automatically feeds cartridges to the device until all the cartridges in the magazine are processed. The operator can supply specific cartridges to an application by inserting the cartridge into the priority cell. The priority cell cartridge is automatically the next cartridge to be loaded into the device, provided a load operation is not currently in progress. When the specific cartridge is completed, the ACF automatically resumes processing cartridges from the magazine.

Processed cartridges can be removed from the magazine and unprocessed cartridges can be added, without disturbing the ACF. The ACF locates each unprocessed cartridge.

When the ACF is in Automatic mode, the following applies (see also “ACF Notes” on page 219):

- Initial conditions:
  - Automatic mode must be selected from the Select ACF Mode menu at the operator panel.

    Note: When the ACF enters Automatic mode from any other mode, the medium changer (mchngr) bit in Inquiry data is set to 0 and the ACF mode in Mode Page X'20' is set to Automatic.
  - The ACF is initialized so the top of the magazine is considered the current cell.
- Enabling Conditions: Two ways to enable Automatic mode follow:
  - Choosing Start on the operator panel, if there is loadable cartridge in the magazine
  - Inserting a cartridge in the import position of the priority cell.
- Disabling conditions: The ACF is disabled in Automatic mode as follows:
  - A magazine or priority cartridge is processed and returned to its original cell, and there is no cartridge in the import position of the magazine or priority cell.
  - The ACF is enabled from the operator choosing Start, but the ACF cannot detect a cartridge in the import position in either the magazine or the priority cell.
  - An attention condition is detected in the ACF; for example, an extra cartridge condition.
- Operation
  1. If the ACF is disabled and in Automatic mode, and the operator chooses Start on the operator panel, the ACF becomes enabled and verifies that there is at least one cartridge in the import position of the magazine. If so, the ACF indexes down the magazine until it finds the first cell with a cartridge in the import position. The ACF sets the cell-status indicator for that cell to in-use (steady green) and moves the cartridge from the cell to the device.
  2. If the ACF is disabled and in Automatic mode and a cartridge is placed in the import position of the priority cell, the ACF is enabled, it loads the cartridge in the device, and it sets the cell-status indicator to in-use (steady green) for the priority cell.
  3. If a cartridge is placed in the priority cell while the ACF is enabled and in Automatic mode, the ACF sets the cell-status indicator of the priority cell to in-use (steady green). When the ACF completes its current operation, it automatically loads the priority cell as described in step 2.
  4. When a cartridge that was loaded while in Automatic mode is unloaded, it is returned to its original cell, if possible, and the in-use indicator for that cell is turned off. The ACF then searches the magazine for the next cell in the import position and loads it in the device. This process repeats until the ACF cannot find another cartridge to load.
- Cleaning the drive in Automatic mode:

  To clean the drive when the ACF is in Automatic mode, place a cleaning cartridge in the priority cell. The cleaning cartridge is automatically loaded, completes its cleaning, and is unloaded into the priority cell again. To determine when cleaning is required, see “Drive Cleaning Indicators” on page 242.

System Mode

System mode provides the operator an additional mechanism to keep the drive continually loaded with cartridges from the magazine. When the ACF is enabled and the first cartridge loaded, subsequent load commands are under the control of the initiator. The ACF loads one cartridge in response to each of these system commands until all the cartridges in the magazine are processed.

System mode does not preclude specific mount requests from the initiator. The operator can supply specific cartridges to an application by inserting the cartridge in the priority cell. The priority cell cartridge is automatically the next cartridge to be loaded in the device, provided a load operation is not currently in progress. When the specific cartridge is complete, the ACF automatically resumes processing cartridges from the magazine under system control.

Processed cartridges can be removed from the magazine and unprocessed cartridges can be added, without disturbing the ACF. The ACF locates each unprocessed cartridge.

When the ACF is in System mode, the following applies (see also “ACF Notes” on page 219):

- Initial conditions
  - System mode must be selected from the Select ACF Mode menu at the operator panel.

    Note: When the ACF enters System mode from any other mode, the medium changer (mchngr) bit in Inquiry data is set to 0 and the ACF mode in Mode Page X'20' is set to System.
  - The ACF is initialized so the top cell of the magazine is considered the current cell location.
- Enabling conditions: Two ways to enable System mode follow:
  - Select Start ACF on the operator panel if there is a loadable cartridge in the magazine.
  - Insert a cartridge in the import position of the priority cell.
- Disabling conditions: The ACF becomes disabled in System mode as follows:
  - A magazine or priority cartridge is processed and returned to its original cell, and there is no cartridge in the import position of the magazine or priority cell.
  - The ACF is enabled from the operator choosing Start, but the ACF cannot detect a cartridge in the import position in either the magazine or the priority cell.
  - An attention condition is detected in the ACF; for example, extra cartridge condition.
- Operation:
  1. If the ACF is disabled and in System mode, and the operator chooses Start on the operator panel, the ACF becomes enabled and verifies that there is at least one cartridge in the import position of the magazine. If so, the ACF indexes down the magazine until it finds the first cell with a cartridge in the import position. The ACF sets the cell-status indicator for that cell to in-use (steady green) and moves the cartridge from the cell to the device.
  2. If the ACF is disabled and in System mode, and a cartridge is placed in the import position of the priority cell, the ACF loads the cartridge in the device and sets the cell-status indicator to in-use (steady green) for the priority cell.

3. If a cartridge is placed in the priority cell while the ACF is enabled and in System mode, the ACF sets the cell-status indicator of the priority cell to in-use (steady green). When the ACF completes its current operation, it automatically loads the priority cell as described in step 2 on page 225.
4. When the system completes processing a cartridge, it issues a Load command with the load bit set to B'0'. The ACF unloads the old cartridge and returns it to its original cell, if possible, and turns off the in-use indicator for that cell. The ACF waits in enabled state until it receives a Load Unload command with the load bit set to B'1', or until a cartridge is inserted in the priority cell. In the case of the Load Unload command, the ACF searches the magazine for the next cell in the import position and loads it to the device. This process repeats until the ACF cannot find another cartridge to load.

- Cleaning the drive in System mode:

  To clean the drive when the ACF is in System mode, place a cleaning cartridge in the priority cell. The cleaning cartridge is automatically loaded, completes its cleaning, and is unloaded into the priority cell again. To determine when cleaning is required, see “Drive Cleaning Indicators” on page 242.

Random Mode

In E-Series Models, the Random Mode functions as if it was a virtual Random 2-LUN Mode. For a description of this E-Series characteristic, see “Random 2-LUN Mode (B-Series Models Only)” on page 228. This change in functionality within Random Mode is exclusive to the E-Series Models a feature of their improved design.

Random mode is designed to act as a small, self-contained library of up to 10 cartridges, controlled by the initiator. The initiator uses the SCSI Medium Mover commands to select a cartridge from a given cell and move it to its destination cell. Control of the source and destination cells are left entirely to the initiator.

Being in Random mode does not preclude initiator requests for specific mounts. Requests for specific cartridges to be mounted can be satisfied by inserting the specific cartridge in the priority cell. In Random mode, the priority cell is simply another addressable cell. The ACF notifies the initiator of the presence of a cartridge in the priority cell, but the initiator must specifically address that cell to access the cartridge.

To ensure the integrity of the library, the magazine has a lock on the magazine. The magazine lock prevents the addition or removal of cartridges from the magazine after the magazine is installed in the ACF and locked. The ACF senses the state of the magazine lock and does not permit Random mode to be enabled unless the magazine lock is set to the locked position. A sensor on the ACF allows the unit to determine that the magazine is not installed or was removed. This disables Random mode.

Because the magazine must be locked in Random mode, the priority cell is used as an I/O port to the library, to add or remove cartridges from the magazine without having to violate the integrity of the locked magazine. The initiator can move cartridges from the priority cell to any empty magazine cell (or the device), or from a magazine cell (or the device) to the priority cell. Library inventory and the control of the inventory is entirely the responsibility of the initiator.

If a Move Medium or Read Element Status command is issued with no magazine present, or with the magazine unlocked, the command fails with a permanent error.

When the ACF is in Random mode, the following applies (see also “ACF Notes” on page 219):

- Initial conditions
  - Random mode must be selected from the Select ACF Mode menu at the operator panel.

    Note: When the ACF enters Random mode from any other mode, the medium changer (mchngr) bit in Inquiry data is set to 1 and the ACF mode in Mode Page X'20' is set to Random.
  - Only when the medium changer (mchngr) bit in Inquiry data is set to 1 does the device accept the Medium Move, Read Element Status, and Prevent Allow Medium Removal commands. These commands control the ACF as described in “Initiator Control of the ACF” on page 220.
  - The ACF is set to enabled and waits for the initiator command to move the media.
- Enabling conditions: Random mode is enabled if all the following conditions are met:
  - The magazine is installed in the ACF.
  - The magazine lock is in the locked state.
  - A valid Move Medium command is received.
- Disabling conditions: The ACF is disabled in Random mode if one of the following conditions are met:
  - The magazine is removed from the ACF.
  - The magazine is unlocked.
  - An attention condition is detected in the ACF; for example, extra cartridge condition.
- Operation:
  1. When first enabled in Random mode, the ACF waits for initiator commands.
  2. All magazine cell-status indicators are set to in-use (steady green). The in-use indicators remain on unless Random mode is disabled. The priority cell cell-status indicator is activated as it is used.
  3. All cartridge movement is under control of the initiator using the Medium Mover commands.
  4. The ACF honors the Prevent Allow Media Removal command by not allowing operator-initiated export of cartridges any time the command has specified Prevent Media Removal.
  5. The priority cell has an assigned element address and can be accessed by the accessor under initiator control. If an operator inserts a cartridge in the priority cell, the ACF notifies the initiator with CHECK CONDITION status and sense data of 6/2801 (Unit Attention, Import or Export Element Accessed). The ACF will not access the cartridge in the priority cell unless commanded by the initiator.
  6. If a cartridge that was loaded while in Random mode is unloaded, it may not always be returned to the same cell where it was previously located. The initiator controls the cartridge location. When the cartridge is placed in a magazine cell, it is placed in the import position.
- Cleaning the drive in Random mode (to determine when cleaning is required, see “Drive Cleaning Indicators” on page 242):

  To clean the drive when the ACF is in Random mode, use one of the following alternatives:

– Place a cleaning cartridge in the priority cell of the ACF and issue a Move Medium command with source address set to the Import Export Element (X'001F') and destination address set to the Data Transfer Element (X'0010'). This must be done when no other cartridge is loaded in the drive.

  When cleaning is complete, either the application must issue the Move Medium directly, or it must permit an operator to issue the command via a utility program. This method will not require another inventory of cartridges.

  Note: The “tapeutil” routine provided with the AIX 3590 driver provides the operator with the means to issue the Move Medium command.

  AS/400 users can run the WRK TAP CTG command and specify the Check Tape Cartridge option on:

  - Volume serial CLNxxx (if the cleaning cartridge is already in the inventory)
  - Volume serial IMPxxx (if the cleaning cartridge was just placed in the priority cell).

- Place a cleaning cartridge in a fixed position in the magazine before loading the ACF and inform the controlling application of that position. The application should periodically load the cleaning cartridge (current recommendation: every 150 GB of tape data (15 full passes of cartridges).
- At a time that is appropriate for the application (and when no cartridges are loaded in the drive), change the ACF mode from Random mode to Manual mode using the operator panel (Manual mode operations from the priority cell do not require that the magazine be unlocked). Insert the cleaning cartridge into the priority cell.

  When the cleaning is complete, the cleaning cartridge is automatically exported to the priority cell. At that time, change the ACF mode back to Random mode. The operator may choose to vary the drive offline during the cleaning period. The application may inventory the ACF again at this time using the Read Element Status command. Optionally, the application may also re-verify the cartridge’s internal labels.

Random 2-LUN Mode (B-Series Models Only)

Random 2-LUN mode is the same as Random mode except for the method by which the SCSI Medium Changer commands are addressed to the SCSI ID of the drive. In Random mode, the 3590 ACF acts as an Attached Medium Changer and supports a limited set of Medium Changer commands at LUN 0 only (1-LUN addressing). In Random 2-LUN mode, the 3590 ACF acts as an Independent Medium Changer and supports Medium Changer commands at LUN 1 only (2-LUN addressing).

This mode should only be selected when specified by the instructions or the certified device lists for all of the software applications to be accessing the 3590 ACF. Many software applications support either 1-LUN addressing or 2-LUN addressing BUT NOT BOTH. Selection of an incorrect mode or incompatible applications in a multi-application environment may result in errors while attempting to access the ACF.

Cell Status Indicators

This section describes the operation of the cell status indicators for the ACF and the priority cell, and the conditions identified by the indicators. The indicators are light emitting diodes (LEDs) that are either off, emitting green light, or emitting yellow light. The indicator operations are described under the following headings:

- "Cell Status: Flashing Yellow is an Attention Indicator"
- "Cell Status: Steady Yellow Indicates Alert Conditions"
- "Cell Status: Steady Green is an In-Use Indicator"

Cell Status: Flashing Yellow is an Attention Indicator

The device requires operator assistance. Table 96 describes the Attention condition. There will be a corresponding operator panel ATTN ACF message in the case where the LEDs indicate attention.

Table 96. Cell Status Indicators Flashing Yellow–Attention Indicator

Indicator State	Description of the Condition
All 11 LEDs -- magazine lights and the priority cell light -- are flashing yellow (Accumulate, Automatic, Manual, and System modes) or all 10 magazine LEDs are flashing yellow (Random mode).	Further activity is stopped. Requires operator attention such as installing the magazine, locking or unlocking the magazine, clearing a cartridge jam, and so on. Once the condition is cleared the LEDs return to normal after Start is selected. Typical supplemental messages to ATTN ACF include extra cartridge, picker error, and export error.

Cell Status: Steady Yellow Indicates Alert Conditions

Does not immediately preclude machine operation, but may, unless the condition is cleared soon. Table 97 describes the Alert condition:

Table 97. Cell Status Indicators Steady Yellow–Alert Conditions

Indicator State	Description of the Condition
All 10 magazine LEDs are steady yellow	Accumulate, Automatic, Manual, or System modes only–Magazine Not Installed or is locked. LEDs return to normal when condition is cleared.
	Automatic, or System modes only–Magazine Processed - no cartridges are in the import position in the magazine or the priority cell. LEDs return to normal when condition is cleared.
	Accumulate mode only–Magazine Full - Warns the operator to remove the full magazine and replace it with one that is not full. LEDs return to normal when Start is selected.
Priority cell light is steady yellow	Priority Cell Demount - Instructs the operator to remove the cartridge in the priority cell.

Cell Status: Steady Green is an In-Use Indicator

The indicated cells are in use by the ACF or the program. Table 98 on page 230 describes the in-use condition:

Table 98. Cell Status Indicators Steady Green–In-Use Indicator

Indicator State	**Description of the Condition**
One magazine light or priority cell light is steady green	Automatic, System and Manual modes only–Indicates that the designated cell is reserved for a cartridge that is presently in the drive.
Multiple magazine LEDs are steady green	Random or Accumulate modes only–Indicates that the designated cells are reserved. Do not put a cartridge in a cell that shows a green light.

Appendix A. SCSI Protocol Implementation Notes for the Magstar

The 3590 Tape Subsystem is comprised of one or more SCSI-2 compliant devices with some important SCSI-3 extensions (deviations are noted). This appendix describes some of the specific 3590 implementation choices made within the SCSI architecture under the following headings:

- "Device Messages"
- "Supported SCSI Status Codes" on page 232

Note: Throughout this appendix, the 3590 is also called "target" and "device."

Device Messages

Table 99 defines the SCSI messages that are supported by the Magstar. In the table, the Target column indicates the messages used while the product is operating as a target. Messages not listed are not supported.

Table 99. Magstar Supported Messages

Message Name	Code	Target Send/Accept
ABORT	X'06'	N Y
ABORT TAG	X'0D'	N Y
BUS DEVICE RESET	X'0C'	N Y
COMMAND COMPLETE	X'00'	Y N
DISCONNECT	X'04'	Y N
IDENTIFY	X'80' - X'FF'	Y[1] Y
IGNORE WIDE RESIDUE	X'23'	Y[2] N
INITIATOR DETECTED ERROR	X'05'	N Y
LINKED COMMAND COMPLETE	X'0A'	Y[2] N
LINKED COMMAND COMPLETE (WITH FLAG)	X'0B'	Y[2] N
MESSAGE PARITY ERROR	X'09'	N Y
MESSAGE REJECT	X'07'	Y Y
NO OPERATION	X'08'	N Y
RESTORE POINTERS	X'03'	Y N
SAVE DATA POINTER	X'02'	Y N
SYNCHRONOUS DATA TRANSFER REQUEST	X'01'	Y[2] Y[2]
WIDE DATA TRANSFER REQUEST	X'01'	Y[2] Y[2]

Field Keys:

```
Y - Yes (Supported)
N - No  (Not Supported)
```

Note:

1. Sent during reselection.
2. The drive (LUN 0) and the ACF (LUN 1) support linked commands, synchronous data transfers, and wide data transfers.

© Copyright IBM Corp. 1996, 2000

Programmer Note: For the Identify Message, we strongly recommend that the Disconnect Privilege bit be set, if you desire error recovery on Data phase.

Supported SCSI Status Codes

The SCSI status codes are defined in the SCSI-2 standard. The Magstar does not use all these status codes. However, the 3590 complies with the SCSI standard for all status codes that it supports. The list of status codes and their use in the Magstar follows:

Status Description

GOOD
Used on the last command of any nexus when the last command finishes correctly. There may be one or more commands per nexus, depending on whether linking has been used.

CHECK CONDITION
Used to report any error condition that generates a contingent allegiance for the command. Unexpected disconnect may be used when the device cannot report by other means. This is an allowable SCSI-2 option. The device prepares sense data for the event that may be retrieved with a Request Sense command. If CHECK CONDITION status is presented, a contingent allegiance does exist. If Unexpected Disconnect is used, sense data is prepared but no contingent allegiance exists (per the SCSI-2 standard).

RESERVATION CONFLICT
Used when an initiator not holding a current reservation attempts to execute an unauthorized command while a reservation is in effect.

INTERMEDIATE
Used as required by SCSI-2. This status code means the equivalent of GOOD status for linked commands (1..n-1).

BUSY Used when required by SCSI-2 (for example, contingent allegiance). The dual port nature of Magstar makes the SCSI-3 behavior extend the BUSY status to a second port. No unnecessary BUSY status is presented. However, some BUSY status reports are required and are presented. BUSY status is presented during the power-up sequence until the diagnostics are complete. Under ordinary circumstances, this is the most common reason for encountering BUSY status.

CONDITION MET
Not Used

INTERMEDIATE-CONDITION MET
Not Used

COMMAND TERMINATED
Not Used

QUEUE FULL
Not Used

Appendix B. Error Sense Information

This appendix lists all possible combinations of Sense Keys, Additional Sense Codes (ASC), and Additional Sense Code Qualifiers (ASCQ) that are reported by the 3590 devices.

Sense Key 0 (No Sense)

Table 100. ASC, and ASCQ Summary for Sense Key 0 (No Sense)

ASC ASCQ	Description	Drive	ACF
00 00	No Additional Sense Information - EOM	X	
00 00	No Additional Sense Information - ILI	X	
00 00	No Additional Sense Information - FM	X	
00 01	Filemark Detected	X	
00 04	Beginning-of-Partition or Medium Detected	X	

Sense Key 1 (Recovered Error)

Table 101. ASC, and ASCQ Summary for Sense Key 1 (Recovered Error)

ASC ASCQ	Description	Drive	ACF
00 00	No Additional Sense Information	X	X
00 17	Drive Needs Cleaning	X	
17 01	Recovered Data with Retries	X	
18 00	Recovered Data with Error Correction Applied	X	
37 00	Rounded Parameter	X	
5B 02	Log Counter at Maximum	X	
83 83	Drive Has Been Cleaned (newer versions of microcode)	X	

Note: Many additional ASC ASCQ combinations are possible if recovered error reporting is enabled via Mode Select. Recovered Error Reporting Enabled is the default option with some of the 3590 device drivers.

Sense Key 2 (Not Ready)

Table 102. ASC, and ASCQ Summary for Sense Key 2 (Not Ready)

ASC ASCQ	Description	Drive	ACF
04 00	Logical Unit Not Ready, Cause Not Reportable	X	X
04 01	Logical Unit Is in Process of Becoming Ready	X	X
04 03	Logical Unit Not Ready, Manual Intervention Required	X	X
04 04	Logical Unit Not Ready, Format in Progress	X	
04 07	Logical Unit Not Ready, Operation in Progress	X	
15 01	Mechanical Positioning Error, Manual Intervention Required		X
30 03	Cleaning in Progress	X	
3A 00	Medium Not Present	X	

© Copyright IBM Corp. 1996, 2000

Table 102. ASC, and ASCQ Summary for Sense Key 2 (Not Ready) (continued)

ASC ASCQ	Description	Drive	ACF
3B 12	Medium Magazine Removed		X
53 00	Media Load or Eject Failed	X	

Sense Key 3 (Medium Error)

Table 103. ASC, and ASCQ Summary for Sense Key 3 (Medium Error)

ASC ASCQ	Description	Drive	ACF
03 02	Excessive Write Errors	X	
09 00	Track Following Error	X	
0C 00	Write Error	X	
11 00	Unrecovered Read Error	X	
11 01	Read Retries Exhausted	X	
11 08	Incomplete Block Read	X	
14 00	Recorded Entity Not Found	X	
14 01	Record Not Found	X	
14 02	Filemark or Setmark Not Found	X	
14 03	End-of-Data Not Found	X	
14 04	Block Sequence Error	X	
30 00	Incompatible Medium Installed	X	
30 01	Cannot Read Medium, Unknown Format	X	
30 02	Cannot Read Medium, Incompatible Format	X	
31 00	Medium Format Corrupted	X	
31 01	Format Command Failed	X	
33 00	Tape Length Error	X	
51 00	Erase Failure	X	
85 00	Write Protected Because of Tape or Drive Failure	X	
85 01	Write Protected Because of Tape Failure	X	
85 02	Write Protected Because of Drive Failure	X	

Sense Key 4 (Hardware Error)

Table 104. ASC, and ASCQ Summary for Sense Key 4 (Hardware Error)

ASC ASCQ	Description	Drive	ACF
09 00	Track Following Error	X	
15 01	Mechanical Positioning Error	X	
3B 00	Sequential Positioning Error	X	
3B 08	Reposition Error	X	
40 00	Diagnostic Failure	X	
44 00	Internal Target Failure Drive Needs Cleaning, Warning Threshold Exceeded	X X	X

Table 104. ASC, and ASCQ Summary for Sense Key 4 (Hardware Error) (continued)

ASC ASCQ	Description	Drive	ACF
47 80	Read Internal CRC Error	X	
47 81	Write Internal CRC Error	X	
4C 00	Logical Unit Failed Self-Configuration	X	
52 00	Cartridge Fault	X	
53 00	Media Load or Eject Failed	X	
53 01	Unload Tape Failure	X	

Sense Key 5 (Illegal Request)

Table 105. ASC, and ASCQ Summary for Sense Key 5 (Illegal Request)

ASC ASCQ	Description	Drive	ACF
1A 00	Parameter List Length Error	X	X
20 00	Invalid Command Operation Code	X	X
21 01	Invalid Element Address		X
24 00	Invalid Field in CDB	X	X
25 00	Logical Unit Not Supported	X	X
26 00	Invalid Field in Parameter List	X	X
26 01	Parameter Not Supported	X	
26 02	Parameter Value Invalid	X	
26 03	Threshold Parameters Not Supported	X	
2C 00	Command Sequence Error	X	
30 05	Cannot Write Medium — Incompatible Format	X	
39 00	Saving Parameters Not Supported	X	
3B 0D	Medium Destination Element Full		X
3B 0E	Medium Source Element Empty		X
3B 11	Medium Magazine Not Accessible		X
3B 80	Medium Transport Element Full		X
3D 00	Invalid Bits in Identify Message	X	X
53 02	Medium Removal Prevented	X	
5B 03	Log List Codes Exhausted	X	
80 00	CU Mode, Vendor-Unique	X	X
85 03	Write Protected Because of Current Tape Position	X	

Sense Key 6 (Unit Attention)

Table 106. ASC, and ASCQ Summary for Sense Key 6 (Unit Attention)

ASC ASCQ	Description	Drive	ACF
00 02	End-of-Partition/Medium Detected, Early Warning	X	
28 00	Not Ready to Ready Transition, Medium May Have Changed	X	X
28 01	Import or Export Element Accessed		X

Table 106. ASC, and ASCQ Summary for Sense Key 6 (Unit Attention) (continued)

ASC ASCQ	Description	Drive	ACF
28 80	Not Ready to Ready Transition, Medium Changer		X
29 00	Power On, Reset, or Bus Device Reset Occurred	X	X
2A 01	Mode Parameters Changed	X	X
2A 02	Log Parameters Changed	X	
2F 00	Commands Cleared by Another Initiator	X	
30 00	Incompatible Medium Installed	X	
3B 12	Medium Magazine Removed		X
3B 13	Medium Magazine Inserted		X
3B 14	Medium Magazine Locked		X
3B 15	Medium Magazine Unlocked		X
3F 01	Microcode Has Been Changed	X	X
3F 02	Changed Operating Definition	X	X
3F 03	Inquiry Data Has Changed	X	X
5A 01	Operator Medium Removal Request	X	
82 83	Drive Has Been Cleaned (older versions of microcode)	X	

Sense Key 7 (Data Protect)

Table 107. ASC, and ASCQ Summary for Sense Key 7 (Data Protect)

ASC ASCQ	Description	Drive	ACF
27 00	Write Protected	X	

Sense Key 8 (Blank Check)

Table 108. ASC, and ASCQ Summary for Sense Key 8 (Blank Check)

ASC ASCQ	Description	Drive	ACF
00 05	End-of-Data Detected	X	
14 01	Record Not Found, Void Tape	X	

Sense Key B (Aborted Command)

Table 109. ASC, and ASCQ Summary for Sense Key B (Aborted Command)

ASC ASCQ	Description	Drive	ACF
14 00	Recorded Entity Not Found	X	
14 01	Record Not Found	X	
14 02	Filemark or Setmark Not Found	X	
1B 00	Synchronous Data Transfer Error	X	X
43 00	Message Error	X	X
44 00	Internal Target Failure	X	X
45 00	Select or Reselect Failure	X	X

Table 109. ASC, and ASCQ Summary for Sense Key B (Aborted Command) (continued)

ASC ASCQ	Description	Drive	ACF
47 00	SCSI Parity Error	X	X
48 00	Initiator Detected Error Message Received	X	X
49 00	Invalid Message Error	X	X
4A 00	Command Phase Error	X	X
4B 00	Data Phase Error	X	X
4E 00	Overlapped Commands Attempted	X	X

Sense Key D (Volume Overflow)

Table 110. ASC, and ASCQ Summary for Sense Key D (Volume Overflow)

ASC ASCQ	Description	Drive	ACF
00 02	End-of-Partition/Medium Detected	X	

Appendix C. Implementation Considerations

Scaled Log Page Counters

For log page counters that add by 1K units (K=1024), the following scaling algorithm applies:

If 0 <= x < 2K items, x = 1 count; if 2K <= x < 3K, x = 2; if 3K <= x < 4K, x = 3; and so on. Drive implementation algorithm: Shift unscaled counter register right 10 bits (divide by 1K), test the remaining contents for zero. If zero, add 1 to scaled log page counter; if greater than zero, add the remaining contents of the unscaled counter to the scaled log page counter. Zero unscaled counter register and restart.

SCSI-ID and LUN Assignments

Every Magstar SCSI interface can be assigned a single SCSI-ID in the range of 0 to 15, but must be the only device on that bus with that ID.

Magstar drives can operate in one of two ways: as a 1-LUN device which combines full Sequential Access support with limited (Attached) Medium Changer support (SCSI-3 option); or as a 2-LUN device that has a separately addressable Sequential Access device and a separately addressable (Independent) Medium Changer device (SCSI-2 or SCSI-3 compatible).

In the 1-LUN case, LUN 0 is the only LUN which is associated with an installed device. All other LUNs are invalid unit addresses as defined in section 7.5.3, Selection of an Invalid Logical Unit in the SCSI-2 standard.

In the 2-LUN case, the Sequential Access device is always LUN 0 and the Medium Changer device is always LUN 1. Note that both device types use the same target address on a port.

Notes:

1. Attached Medium Changer (1-LUN addressing) is the default operating definition for all ACF modes of operation except Random 2-LUN (see “Change Definition -X‘40’” on page 10).
2. The SCSI-ID is factory set to X'03' but may be changed using the operator panel menus.
3. The Magstar SCSI-ID may be assigned any value from 0 to 15, but must be the only device on the bus with that ID.
4. A diagnostic, Change SCSI ID, allows the SCSI-ID to be temporarily set to a value other than its default to allow factory tests at different SCSI-IDs, without physically changing the address.

Multiple Port Behavior

The two SCSI ports of a 3590 provide alternate paths through which the logical unit(s) of a 3590 may be reached. The ports are referred to as Port 0 and Port 1. Each port has it’s own unique SCSI ID. When operating as an Independent Medium Changer (2-LUN addressing), both LUN 0 and LUN 1 are available through both ports.

Using the operator panel, the operator may manually set each port in an online or offline state. Additionally, the operator may select to enable an Auto-Share function

© Copyright IBM Corp. 1996, 2000

which will dynamically set one port offline when the drive or ACF logical unit has been reserved via a SCSI command and, conversely, will set the port online when the logical unit has been released via a SCSI command.

Note: If a port is not connected, the operator must set the port “Offline” at the operator panel to avoid a false detection of an active SCSI reset signal.

Behavior with Auto-Share Disabled

Usage of the 3590 with both ports online and with Auto-Share disabled is not recommended. Generally, the drive behavior with Auto-Share disabled is such that all initiators, regardless of port, are treated the same as multiple initiators on the same port. The exception to this is the handling of mode pages and reservations (both unit and element) when a hard reset condition occurs. The following rules are described with respect to a local bus (the SCSI bus on which the hard reset condition occurred) and a remote bus (the other SCSI bus to which the 3590 is attached). When operating as an Independent Medium Changer, the rules apply separately for each logical unit (in other words, one rule will apply for LUN 0 while a different rule might apply for LUN 1).

1. If there are no reservations when a hard reset condition occurs, all mode pages are reset. All initiators on the local bus receive a Unit Attention condition for Power On, Reset, or Bus Device Reset Occurred. All initiators on the remote bus receive a Unit Attention condition for Mode Parameters Changed.
2. If there are one or more reservations when a hard reset condition occurs and all reservations were granted to initiators on the local bus, all mode pages are reset and all reservations are reset. All initiators on the local bus receive a Unit Attention condition for Power On, Reset, or Bus Device Reset Occurred. All initiators on the remote bus receive a Unit Attention condition for Mode Parameters Changed.
3. If there are one or more reservations when a hard reset condition occurs and one or more of the reservations were granted to an initiator on the remote bus, only those mode pages and reservations unique to each initiator on the local bus are reset. Mode pages and reservations unique to each initiator on the remote bus are not reset. Mode pages which are defined as common to all initiators are not reset. All initiators on the local bus receive a Unit Attention condition for Power On, Reset, or Bus Device Reset Occurred. All initiators on the remote bus see no effects of the hard reset condition on the other bus.

Behavior with Auto-Share Enabled

When Auto-Share is enabled, the drive treats a SCSI reservation of a logical unit as a trigger to set the remote port offline. Consequently, the drive treats a SCSI release of a logical unit as a trigger to set the remote port online. The offline state of the remote port in this scenario is referred to as ‘auto-offline’. In order to eliminate the exposure of a host on the remote port accessing the media belonging to the reserving host , the auto-offline state of the remote port is not reset by a hard reset condition on the online local port, even though the logical unit reservations are cleared. The auto-offline port may only be set online by one of the following events:

- Processing of a valid SCSI Release command which completes with no reservations existing for a logical unit
- Power-on-reset of the drive
- Operator selection of the menu option to set the port online

When the auto-offline port is set online, all initiators on that port receive a Unit Attention condition.

The handling of mode pages and reservations when a hard reset condition occurs with Auto-Share enabled is the same as with Auto-Share disabled (see Behavior with Auto-Share Disabled) except that there are no Unit Attention conditions for initiators on a remote bus if the remote port is in an auto-offline state.

Data Transfer, Block Limits, and Fixed Block Option

The Magstar drive is designed to buffer multiple records. Logical blocks may be prefetched to the buffer before they are requested by a Read command or held in the buffer after they are written by a Write command. For successive sequential-motion operations, the presence of the buffering in the device does not adversely affect the performance of the subsystem. Non-sequential motion does not result in errors, but may result in delays because of requirements to synchronize buffers or discard read ahead data. Buffer management in the device determines when to read additional data from the medium into the buffer, or when to write data from the buffer to the medium. A logical block is not written to tape until the block is entirely received into the buffer.

When the Fixed bit of the Read or Write command is set to B'1', each Read or Write command transfers zero or more logical blocks. The subsystem takes appropriate action to assemble or disassemble the logical blocks being transferred over the interface so that they remain independent blocks on the medium. There is no guarantee that the group of blocks transferred by the Write command is requested as a group by a subsequent Read command, so the device must be prepared to assemble and disassemble on a block boundary. This is managed by treating all blocks and filemarks as independent from one another, both for data compaction and for recording. The use of the Save Data Pointers message at logical block boundaries during the transfer assists in recovery actions in the middle of the transfer (that is, only the last logical block needs to be retransferred). Disconnection between logical blocks may also occur if the subsystem requires additional time to process logical blocks being transferred.

When the Fixed bit of the Read or Write command is set to B'0', each Read or Write command transfers a single logical block.

After EOT is reached on any Write command, only a single block is transferred before terminating the command with check condition status 0/0000 (No Sense, No Additional Sense Information) and EOM set to B'1'. The same is true for Write Filemark commands.

The device supports a minimum logical block length of 1 and a maximum logical block length is 2,097,152 bytes (X'200000'). Any block length between the limits is also supported. Refer also to “Read Block Limits - X‘05’” on page 133 for further information on block sizes and limitations.

Note: Odd-byte transfer (fixed or variable) width can only be one byte. For these transfers, the maximum burst data rate is 10MB per second (one-half the normal Magstar drive burst data rate). The drive negotiates narrow before the data phase.

Cleaning the Drive in the 3494 Library

In the 3494 no ACF exists; thus no notion of ACF Library mode exists. However, the drive is automatically cleaned in the 3494 library as it is in the 3495 library.

When the drive determines that either maintenance cleaning is required, or that the SARS thresholds have been reached, a message is sent to the library (via the RS-422 interface) to request cleaning. This occurs when the Cleaning message is normally sent to the drive operator panel. The 3494 Library Manager schedules the mounting of the cleaning cartridge. Thus, the host operating system and application are freed of any responsibility to facilitate the cleaning.

For information on cleaning drives that are not installed in a library, see the ACF mode descriptions beginning with “Manual Mode” on page 221.

Drive Cleaning Indicators

For stand-alone drive models, automatic cleaning of the drive is not possible. For library models, automatic cleaning of the drives by the library may be disabled (although it is not recommended). For either case, cleaning of the drives must be managed by the host application or manually, by the operator.

Note: Failure to clean a drive may result in data loss.

This section describes how cleaning indicators are presented from the drive. The cleaning indicators may be presented even with automatic cleaning enabled in a library environment. The cleaning indicators can be presented through the following:

- “Operator Panel Cleaning Indication”
- “SCSI Interface — Dynamic Cleaning Indicators”
- “SCSI Interface — Static Cleaning Indicator (Sense Data Byte 70)” on page 243

Operator Panel Cleaning Indication

For Magstar ACF models, a CLEAN message is displayed on the operator panel display when cleaning with a cleaning cartridge is required. For additional details, see the Operator Guide for this product.

SCSI Interface — Dynamic Cleaning Indicators

Dynamic cleaning indicators that are sent across the SCSI interface include:

- ASC/ASCQ codes related to cleaning in Table 111.

Table 111. ASC/ASCQ Codes Related to Cleaning

Code Description	Sense Key	ASC/ASCQ
Drive Needs Cleaning	1	00/17
Drive Has Been Cleaned (newer versions of microcode)	1	83/83
Cleaning in Progress (cleaner cartridge installed)	2	30/03
Drive Needs Cleaning, Warning Threshold Exceeded	4	44/00
Drive Has Been Cleaned (earlier versions of microcode)	6	82/83

- Service Information Message (SIM) bytes 20-21 of Log Page X'31' (SIM availability is shown in sense data):

Value (ASCII)	Description
’55’	Drive Needs Cleaning. Load Cleaning Cartridge
’57’	Drive Has Been Cleaned

Note: If the device driver shields the application from dynamic notifications, the information is usually available from the system error log.

SCSI Interface — Static Cleaning Indicator (Sense Data Byte 70)

The bit significance of sense data byte 70 follows:

Bit	Description
7	Set to B'1' “Cleaning Required: Normal Maintenance” when cleaning is required because of the normal preventive maintenance guideline (that is, every 150GB). This bit is set when the Cleaning message is generated for display (for this case). Reset to B'0' when the cleaning cartridge is loaded.
6	Set to B'1' “Cleaning Required: Threshold Reached” when cleaning is required based on other internal threshold criteria. This bit is set when the Cleaning message is generated for display (for this case). Reset to B'0' when the cleaning cartridge is loaded.
5-0	Set to B'000000' “Reserved.” These bits will be used for future cleaning criteria, including the following: • Performance-driven cleaning • Wet cleaning • Dry brush cleaning

Notices

References in this publication to IBM programs or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program, or service is not intended to state or imply that only IBM's product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any of IBM's intellectual property rights may be used instead of the IBM product, program, or service. Evaluation and verification of operation in conjunction with other products, except those expressly designed by IBM, are the user's responsibility.

IBM may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to the IBM Director of Licensing, IBM Corporation, 500 Columbus Avenue, Thornwood, NY 10594, U.S.A.

Do You Have Comments or Suggestions?

Your feedback is important in helping to provide the most accurate and high-quality information. If you have comments or suggestions for improving this publication, you can send us comments electronically by using these addresses:

- Internet: starpubs@vnet.ibm.com (or starpubs at vnet.ibm.com)
- IBMLink from U.S.A.: STARPUBS at SJEVM5
- IBMLink from Canada: STARPUBS at TORIBM
- IBM Mail Exchange: USIB3VVD at IBMMAIL
- Fax from U.S.A. and Canada: 520 799-2906
- Fax from other countries: 520 799-2906

You can also mail your comments by using the Reader Comment Form in the back of this manual or direct your mail to:

IBM Corporation
Information Development, Department 61C
9000 South Rita Road
Tucson, AZ 85744-0001, U.S.A.

When you send information to IBM, you grant IBM a nonexclusive right to use or distribute the information in any way it believes appropriate without incurring any obligation to you.

© Copyright IBM Corp. 1996, 2000

Terms

For definitions of terms, abbreviations, and acronyms, refer to the “Glossary” on page 251. This comprehensive reference contains terms used in this publications.

Trademarks

The following terms are trademarks of the IBM Corporation in the United States or other countries or both:

ADSTAR
AIX
ESA/390
ES/3090
IBM
RS/6000
S/390
SP2
System/390
Application System/400
AS/400
ESCON
ES/9000
RS/6000 SP
S/390 Parallel Transaction and Enterprise Servers
RS/6000 SP
System/370

The following terms are trademarks of other companies:

Adaptec
Sun
StorageTek
Windows NT
Hewlett-Packard
Sun Microsystems, Inc.
Storage Technology Corporation

Microsoft, Windows, and Windows NT are registered trademarks of Microsoft Corporation.

IBM Agreement for Licensed Internal Code

You accept the terms of this Agreement by your initial use of a machine that contains IBM Licensed Internal Code (called “Code”).

These terms apply to Code used by certain machines IBM or your reseller specifies (called “Specific Machines”). International Business Machines Corporation or one of its subsidiaries (“IBM”) owns copyrights in Code or has the right to license Code. IBM or a third party owns all copies of Code, including all copies made from them.

If you are the rightful possessor of a Specific Machine, IBM grants you a license to use the Code (or any replacement IBM provides) on, or in conjunction with, only the Specific Machine for which the Code is provided. IBM licenses the Code to only one rightful possessor at a time.

Under each license, IBM authorizes you to do only the following:

1. Execute the Code to enable the Specific Machine to function according to its Official Published Specifications (called “Specifications”);
2. Make a backup or archival copy of the Code (unless IBM makes one available for your use), provided you reproduce the copyright notice and any other legend of ownership on the copy. You may use the copy only to replace the original, when necessary; and
3. Execute and display the Code as necessary to maintain the Specific Machine.

You agree to acquire any replacement for, or additional copy of, Code directly from IBM in accordance with IBM’s standard policies and practices. You also agree to use that Code under these terms.

You may transfer possession of the Code to another party only with the transfer of the Specific Machine. If you do so, you must 1) destroy all your copies of the Code that were not provided by IBM, 2) either give the other party all your IBM-provided copies of the Code or destroy them, and 3) notify the other party of these terms. IBM licenses the other party when it accepts these terms. These terms apply to all Code you acquire from any source.

Your license terminates when you no longer rightfully possess the Specific Machine.

Actions You May Not Take

You agree to use the Code only as authorized above. You may not do, for example, any of the following:

1. Otherwise copy, display, transfer, adapt, modify, or distribute the Code (electronically or otherwise), except as IBM may authorize in the Specific Machine’s Specifications or in writing to you;
2. Reverse assemble, reverse compile, or otherwise translate the Code unless expressly permitted by applicable law without the possibility of contractual waiver;
3. Sublicense or assign the license for the Code; or
4. Lease the Code or any copy of it.

AIX License Information Additional Terms and Conditions

As pertaining to AIX code within the 3590 Model A00 and A50, the following applies.

This software and documentation is based in part on the Fourth Berkeley Software Distribution under license from the Regents of the University of California. We acknowledge the following institutions for their role in its development: the Electrical Engineering and Computer Sciences Department at the Berkeley campus.

The Fourth Berkeley Software Distribution is provided by the Regents of the University of California and other contributors on an “AS-IS” basis. NEITHER THE REGENTS OF THE UNIVERSITY OF CALIFORNIA NOR THE OTHER CONTRIBUTORS MAKE ANY WARRANTIES, EITHER EXPRESS OR IMPLIED, AS TO ANY MATTER WHATSOEVER, INCLUDING WITHOUT LIMITATION, THE CONDITION OF THE FOURTH BERKELEY SOFTWARE DISTRIBUTION, ITS MERCHANTABILITY OR ITS FITNESS FOR ANY PARTICULAR PURPOSE.

The Regents of the University of California and other contributors are under no obligation to provide either maintenance services, update services, notices of latent defects, or correction of defects for the Fourth Berkeley Software Distribution.

Communication Statements

Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits of a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that my cause undesired operation.

Canadian Department of Communications Compliance Statement

This equipment does not exceed Class A limits per radio noise emissions for digital apparatus, set out in the Radio Interference Regulation of the Canadian Department of Communications.

Avis de conformité aux normes du ministère des Communications du Canada

Cet équipement ne dépasse pas les limites de Classe A d'émission de bruits radioélectriques pour les appareils numériques, telles que prescrites par le Règlement sur le brouillage radioélectrique établi par le ministère des Communications du Canada.

European Union (EU) Electromagnetic Compatibility Directive

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Attention: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take adequate measures.

Germany Electromagnetic Compatibility Directive

Dieses Gerät ist berechtigt in Übereinstimmung mit dem deutschen EMVG vom 9.Nov.92 das EG-Konformitätszeichen zu führen. Der Au*β*teller der Konformitätserklärung ist die IBM.

Dieses Gerät erfüllt die Bedingungen der EN 55022 Klasse A. Für diese Klasse von Geräten gilt folgende Bestimmung nach dem EMVG: Geräte dürfen an Orten, für die sie nicht ausreichend entstört sind, nur mit besonderer Genehmigung des Bundesminesters für Post und Telekommunikation oder des Bundesamtes für Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Störungen zu erwarten sind. (Auszug aus dem EMVG vom 9.Nov.92, Para.3, Abs.4)

Hinweis:

Dieses Genehmigungsverfahren ist von der Deutschen Bundepost noch nicht veroöffentlicht worden.

New Zealand Compliance Statement

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Taiwan Class A Statement

警告使用者:
這是甲類的 資訊產品，在
居住的環境中使用時，可
能會造成射頻干擾，在這
種情況下，使用者會被要
求採取某些適當的對策。

Japan Voluntary Control Council for Interference Statement

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づく第一種情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

Glossary

This glossary defines the special terms, abbreviations, and acronyms that are used in this publication. If you do not find the term you are looking for, refer to the index or to *IBM Dictionary of Computing,* New York: McGraw-Hill, 1994.

A

ABEND. Abnormal end of task.

access method. A technique for moving data between processor storage and input/output devices.

ADSM. ADSTAR Distributed Storage Manager.

ANSI. American National Standards Institute.

archiving. The storage of backup files and associated journals, usually for a given period of time.

archiving application. The retention of records, in machine-readable form, for historical purposes.

argument. Any value of an independent variable.

ASC. Additional Sense Code.

ASCQ. Additional Sense Code Qualifier.

automatic mode. A mode of operation that can be selected on the cartridge loader. This mode allows the automatic feeding and loading of premounted tape cartridges requiring no operator action.

B

beginning of tape (BOT). The location on a magnetic tape that indicates the beginning of the permissible recording area.

block. A collection of contiguous records recorded as a unit. Blocks are separated by interblock gaps, and each block may contain one or more records.

BOT. Beginning of tape.

bpi. Bits per inch.

BPI. Bytes per inch.

buffer. A routine or storage used to compensate for a difference in rate of flow of data, or time of occurrence of events, when transferring data from one device to another.

buffered mode. The buffered mode allows a number of logical blocks to accumulate in the control unit buffer before the data is transferred to the device or channel. This mode is suppressed automatically, if the record exceeds the maximum buffered capacity.

C

capacity. See *media capacity*.

cartridge loader. A standard function for the tape drive that allows the manual loading of single tape cartridges.

CDB. Command description block.

command. A control signal that initiates an action or the beginning of a sequence of actions. See also *channel command*.

contingent allegiance. (1) A condition in which a drive owes a response to a specific channel path because of a unit check. (2) A condition generated by a check condition status during which a target preserves sense data.

conversion. The process of changing from one method of data processing to another or from one data-processing system to another.

D

DASD. Direct-access storage device.

data. Any representations such as characters or analog quantities to which meaning is, or might be, assigned.

data base. A set of data, consisting of at least one file, that is sufficient for a given purpose or for a given data-processing system.

data compression. An algorithmic data-reduction technique that encodes data from the host and stores it in less space than unencoded data. The original data is recovered by an inverse process called decompression.

data-compression ratio. The number of host data bytes divided by the number of encoded bytes. It is variable depending on the characteristics of the data being processed. The more random the data stream, the lower the opportunity to achieve compression.

dataset. The major unit of data storage and retrieval, consisting of a collection of data in one of several prescribed arrangements and described by control information to which the system has access.

deferred unit check. A condition in which a drive returns a unit check indication for an event that

© Copyright IBM Corp. 1996, 2000

occurred asynchronously with the channel commands. The deferred unit check may not refer to the command that receives the indication.

drive loaded. A condition of a tape drive in which a tape cartridge has been inserted in the drive, and the tape has been threaded to the beginning-of-tape position.

dump. To write the contents of storage, or of a part of storage, usually from an internal storage to a external medium, for a specific purpose such as to allow other use of storage, as a safeguard against faults or errors, or in connection with debugging.

E

effective data rate. The average number of bits, bytes, characters, or blocks per unit time transferred from a data source to a data sink and accepted as valid. The rate is expressed in bits, bytes, characters, or blocks per second, minute, or hour.

effective recording density. The number of user bytes per unit of length of the recording medium.

enable. To provide the means or opportunity. The modification of system, control unit, or device action through the change of a software module or a hardware switch (circuit jumper) position.

ERA. Error-recovery action performed by the host.

ERP. See *error-recovery procedures*.

error-recovery procedures (ERP). (1) Procedures designed to help isolate and, where possible, to recover from errors in equipment. The procedures are often used in conjunction with programs that record the statistics of machine malfunctions. (2) Error-recovery procedures performed by the subsystem.

explicitly activated. A process in which the attributes of an identifier are specified. Contrast with *implicitly activated*.

extended contingent allegiance. (1) A condition caused by a permanent buffered-write error in which the drive responds only to the channel path group from which the write command was received. The extended contingent allegiance continues until a controlling computer in the channel path group retrieves the unwritten data from the buffer or issues a tape motion command. (2) A condition generated by an initiate recovery message to assist in extended error recovery procedures in multi-initiator systems.

F

field replaceable unit (FRU). An assembly that is replaced in its entirety when any one of its components fails. In some cases a field replaceable unit may contain other field replaceable units; for example, a brush and a brush block that can be replaced individually or as a single unit.

file. A set of related records, treated as a unit; for example, in stock control, a file could consist of a set of invoices.

file protected. Pertaining to a tape volume from which data can be read only. Data cannot be written on or erased from the tape.

format. The arrangement or layout of data on a data medium.

FRU. Field replaceable unit.

G

GB. Gigabyte; 1 000 000 000 bytes of storage.

H

host system. A data-processing system that is used to prepare programs and the operating environments for use on another computer or controller.

I

implicitly activated. A process in which the attributes of an identifier are determined by default. Contrast with *explicitly activated*.

initiator. A SCSI device that requests an I/O process to be performed by another SCSI device (a target). In many cases, an initiator can also be a target.

install. To set up for use or service. The act of adding a product, feature, or function to a system or device either by a singular change or by the addition of multiple components or devices.

interchange application. The preparation of tapes for use on other systems or devices, either local or remote, or the use of tape data prepared by another system.

interposer. An interposer is a part used to convert a 68-pin connector to a 50-pin D-shell connector.

invoke. To petition for help or support. The request for a feature or function to be utilized in future processing activities through the use of software or hardware commands.

J

journaling. Recording transactions against a dataset so that the dataset can be reconstructed by applying transactions in the journal against a previous version of the dataset.

K

KB. Kilobyte; 1 024 bytes of storage.

L

loader. See *cartridge loader*.

load point. The beginning of the recording area on magnetic tape.

logical end of tape. A point on the tape where written data normally ends.

LSB. Least significant bit.

LUN. Logical unit number.

M

MB. Megabyte; 1 000 000 bytes of storage.

magnetic recording. A technique of storing data by selectively magnetizing portions of a magnetizable material.

magnetic tape. A tape with a magnetizable surface layer on which data can be stored by magnetic recording.

magnetic tape drive. A mechanism for moving magnetic tape and controlling its movement.

manual mode. A mode of operation that can be selected on the cartridge loader. This mode allows a single tape cartridge feed, performed by the operator.

media capacity. The amount of data that can be contained on storage media and expressed in bytes of data.

microprocessor. An integrated circuit that accepts coded instructions for execution; the instructions may be entered, integrated, or stored internally.

microprogram. (1) A sequence of elementary instructions that correspond to a specific computer operation which is maintained in special storage; and whose execution is initiated by the introduction of a computer instruction into the instruction register of a computer. (2) A group of micro instructions that when executed perform a preplanned function.

migration. See *conversion*.

MSB. Most significant bit.

O

OEM. Original equipment manufacturer.

P

physical end of tape. A point on the tape beyond which the tape is not permitted to move.

POR. Power-on reset.

primed. Pertaining to a condition of a tape drive when the controlling computer addresses the drive but the drive is not in a ready state.

processing application. The execution of a systematic sequence of operations performed on data to accomplish a specific purpose.

Program Temporary Fix. PTF

PTF. Program Temporary Fix

Q

quiesce. To bring a device or system to a halt by a rejection of new requests for work.

R

read-type commands. Any commands that cause data to be read from tape.

record. A collection of related data or words, treated as a unit; for example, in stock control, each invoice could constitute one record.

recording density. The number of bits in a single linear track measured per unit of length of the recording medium.

retension (or refresh). The process or function of tightening the tape onto the cartridge, if it is sensed that the tape has a loose wrap on the cartridge.

S

SCSI. Small Computer System Interface.

SCSI address. The octal representation of the unique address (0–F) assigned to a SCSI device. This address would normally be assigned and set in the SCSI device during system installation.

SCSI device. A host adapter or a target controller that can be attached to the SCSI bus.

SCSI ID. The bit-significant representation of the SCSI address referring to one of the signal lines DB (F–0).

special feature. A specific design addition to an IBM product that is quoted in the IBM Sales Manual and ordered separately.

standard function. The significant design elements of an IBM product that are included as part of the basic standard product.

synchronization. The process of coordinating the activities of the controlling computer and the magnetic tape subsystem to obtain the condition in which the buffer is empty and the tape is in the correct position for the next operation.

system mode. A mode of operation that can be selected on the cartridge loader. This mode allows the automatic feeding and loading of premounted blank or scratch tape cartridges in response to non-specific volume requests, while specific volume requests require operator insertion of the requested tape cartridge.

T

tape cartridge. A container holding magnetic tape that can be processed without separating it from the container.

tape drive. A device that is used for moving magnetic tape and includes the mechanisms for writing and reading data to and from the tape.

tape synchronous mode. The tape synchronous mode transfers records whose length is greater than the limits defined for buffered records. The device operates in the tape synchronous mode, if the format being processed is supported.

tape unit. A device that contains tape drives and their associated power supplies and electronics.

target. A SCSI device that performs an operation requested by the initiator. In many cases, a target can also be an initiator.

target routine. A target routine is an I/O process directed to a target, and not to a logical unit.

terminator. A part used to end a channel or connection on a computer system.

V

volume. (1) A certain portion of data, together with its data carrier, that can be handled conveniently as a unit. (2) A data carrier that is mounted and demounted as a unit, for example, a reel of magnetic tape, a disk pack.

volume control region (VCR). A region on the medium that contains volume control information.

W

write-type commands. Any commands that cause data to be written on tape or affect buffered write data.

Index

Numerics

3494
  publications ix
3494 library, cleaning drives in 241
3590
  introduction to 1
  publications ix
3590 SCSI commands
  change definition 7, 10, 190
  compare 7
  copy 7
  copy and verify 7
  display message 7, 12
  erase 7, 15
  exchange medium 190
  format medium 7
  initialize element status 192
  inquiry 7, 16, 190, 193
  load unload 7, 26
  locate 7, 28
  log select 7, 30, 190
  log sense 7, 32, 190, 196
  mode select (10) 7, 79
  Mode Select (10) 190, 198
  mode select (6) 7, 74
  Mode Select (6) 190, 197
  mode sense (10) 7, 88
  Mode Sense (10) 190, 200
  mode sense (6) 7, 83
  Mode Sense (6) 190, 199
  move medium 7, 126, 190, 202
  Persistent Reserve In 7
  Persistent Reserve In - X‘5E’ 127
  Persistent Reserve Out 7
  Persistent Reserve Out - X‘5F’ 129
  position to element 190, 203
  prevent allow medium removal 130, 190
  read 131
  read block limits 7, 133
  read buffer 7, 134, 190
  read command 7
  read element status 7, 137, 190, 204
  read position 7, 138
  read reverse 7, 141
  receive diagnostic results 7, 143, 190, 213
  recover buffered data 7, 145
  release 214
  release element (6) 190
  release unit 7, 8, 146
  Report Density Support 147
  Report LUNs 8
  Report LUNs - X‘A0’ 150
  request sense 8, 151, 190, 215
  request volume element address 190
  reserve 190, 216
  reserve unit 8, 158
  rewind 8, 159
3590 SCSI commands *(continued)*
  rezero unit 190
  send 8
  send diagnostic 8, 160, 190, 217
  send volume tag 190
  space 8, 183
  test unit ready 8, 184, 190, 218
  unsupported 5
  verify 8
  write 8, 185
  write buffer 6, 8, 186, 190
  write filemarks 8, 187

A

abort
  message 231
  tag message 231
Access 208, 209, 210, 211
accumulate mode, ACF 222
accumulate mode, cleaning the drive 223
AckReqQ 18
active format 98
active partition 98
additional
  partitions defined 101
  sense code (ASC) 152
  sense code qualifier (ASCQ) 152
  sense length 152
additional publications x
Addr16 18
Addr32 18
AERC 17
analog card hardware errors 67
ANSI approved version 17, 19
architectural issues
  block length constraints 241
  microcode revision level 18
  plant of manufacture association 18
  product revision level 18, 20
  read (fixed bit) 241
  Read Block Limits 241
  serial number 18
  serial number association 18
  soft-reset alternative 18, 20
  supported commands 231
  supported messages 231
  write (fixed bit) 241
ASC 152, 207, 208, 209, 210, 211, 233
ASC/ASCQ codes
  1/3700 (Recovered Error, Rounded Parameter) 112
  2/0403 (Not Ready, Logical Unit Not Ready - Manual Intervention Required). 204
ASC/ASCQ codes related to cleaning 242
ASCQ 152, 207, 208, 209, 210, 211, 233
ASOCWP 99
associated write protect 116
Association 24, 194

© Copyright IBM Corp. 1996, 2000

automatic mode, cleaning the drive 224
automatic velocity control (AVC) 98
AVolTag 205

B

BarC 17
beginning of partition 156
bellcord actions 49, 56
BIS 98
bit pointer field 153
block
  address format 28
  control field format 156
  descriptor 77, 82
  descriptor (mode sense) 86
  descriptor length (mode select command) 82
  descriptor length (mode sense command) 85, 90
  id sequence errors 53
  length 86
  length constraints 241
  length limits 133
blocks
  corrected count 47, 51
  lifted 50
  or bytes transferred page 59
BOP 138, 139
BPV 153
BQue 17
BT 28, 138
buffer
  empty ratio 95
  full ratio 95
  size at early warning 99
buffered mode 82, 85, 90
bus device reset message 231
bus inactivity limit 95
byte order field 141

C

C/D 152
CAF 98
CAP 98
capacity of partition, nominal 62
capacity scaling 119
capacity scaling valid 119
CapScalV 119
cartridge initialization errors 56
change definition command 7, 10, 190
change partition 98
changes, summary of xiii
cleaning the drive
  ASC/ASCQ codes related to cleaning 242
  dynamic indicators, SCSI 242
  in accumulate mode 223
  in automatic mode 224
  in manual mode 222
  in random mode 227
  in system mode 226
  in the 3494 library 241
  indicators 242
cleaning the drive *(continued)*
  operator panel indication 242
  static indicators 243
CmdQue 18
Code Set 24, 194
command
  -specific information 152
  complete message 231
commands, SCSI
  change definition 7, 10, 190
  compare 7
  copy 7
  copy and verify 7
  display message 7, 12
  erase 7, 15
  format medium 7
  inquiry 7, 8, 16, 193
  load/unload 7, 26
  locate 7, 28
  log select 7, 30
  log sense 7, 32
  mode select (10) 7, 79
  mode select (6) 7, 74
  mode sense (10) 7, 88
  mode sense (6) 7, 83
  move medium 7, 126, 202
  prevent allow medium removal 7, 130
  read 7, 131
  read block limits 7, 133
  read buffer 7, 134
  read element status 7, 137, 204
  read position 138
  read reverse 7, 141
  receive diagnostic results 7, 143
  recover buffered data 7, 127, 129, 145, 150
  release unit 7, 8, 146
  request sense 8, 151
  reserve unit 8, 158
  rewind 8, 159
  send diagnostic 8, 160
  space 8, 183
  test unit ready 8, 184
  verify 8
  write 8, 185
  write buffer 6, 8, 186
  write filemarks 8, 187
communication statements 249
compactor errors 67
compare command 7
Compression Algorithm 97
ComQue 20
connect time limit 95
control mode page 96
copy and verify command 7
copy command 7
CP 28

D

data
  flow hardware errors 67
  transfer element address 202

Data Compression 97
Data Compression Capable 97
Data Compression Enabled 97
data flow clock adjusted 55
Data Transfer Disconnect Word 95
data transfer element address 106
DBD 83, 85, 88, 91
DBR 98
DCC 97
DCE 97
DCR 93
DDE 97
dead reckoning
  high 54
  low 55
  nominal 54
Decompression Algorithm 97
definition parameter 10
density code
  mode select command 78
  mode sense command 86
device
  -specific parameters 82, 85, 90
  block control flags 156
  block number 156
  block type id 156
  capabilities page 108
  message 44
  read blocks processed 60
  read blocks transferred 61
  read bytes processed 60
  read bytes transferred 61
  type modifier 19
  write blocks recorded 60
  write blocks transferred 61
  write bytes recorded 60
  write bytes transferred 61
device type and model number 18
DevOfL 160
disconnect
  message 231
  time limit 95
display message command 7, 12
DQue 96
drive serial number 18
DS 43
DS field 33
DT 108
DTDC 95
DTE 93
DU 43
DU field 33
dual port busy status 232
dump and error data buffer 135
dump available 153
DUP 148

E

EAERP 96
ECC data errors 53
ECC hardware errors 67
ECMA version 17, 19
edge track 120
EEG 99
EER 93
element
  address assignment 106
  descriptor length 205
  status data 205
  type code 205
EMDP 95
Enable Modify Data Pointers 95
EncServ 17
EOD defined 99
EOM 152
EOP 138, 140
EOT 26
equipment check errors page 66
equipment flags 18
erase command 7, 15
Error Asynchronous Event Reporting 96
error code 151
ETC field 33, 43
EVPD 16, 19, 21, 22, 23, 24, 193, 194
Except 207, 208, 209, 210, 211
exception data 44
exception message code 44, 45
exchange medium 190
ExEnab 209

F

failing command 155
Fair Arbitration Write 95
FARd 95
FAStat 95
FAStat (Fair Arbitration Status) 95
FAWrt 95
FDP 102
Fibre Channel Logical Unit Control page 104
Fibre Channel Port Control page 105
field microcode replacement (FMR) 6, 186
field pointer 153
field replaceable unit code 152
filemarks 98, 151, 183, 187
first
  block location 139, 140
  element address reported 205
  error code 153
  error code flags 155
  FSC 45
  logical block number 156
First Burst Size 95
fixed
  bit in Write/Read 241
  read command 131
  read reverse command 141
  recover buffered data command 145
  write command 185
FMR cartridge 6, 186
format
  buffer errors 67
  identifier 115

format *(continued)*
incompatible 155
medium command 7
fraction of partition currently traversed 62
fraction of volume currently traversed 62
FRU code 152
FRU identifier field 45
FSE, first 45
FSE, last 45
Full 207, 208, 209, 210, 211

G

gap size 99
Global Logging Target Save Disable 96
GLTSD 96

H

hardware SIM 43
Hierarchical Support 17
HiSupport 19

I

I/E 108
ID Valid 210, 211
Identifier Type 24, 194
identify message 231
IDP 102
ignore data checks on locate command 124
ignore data checks on space blocks 124
ignore data checks on space filemarks 124
ignore sequence checks on locate command 124
ignore sequence checks on space blocks 124
ignore sequence checks on space filemarks 124
ignore wide residue message 231
ILI 148, 152
Immed 15, 26, 28, 159, 187
import/export element address 106, 202
indicators, cleaning 242
InEnab 209
information 152
initialize element status command 192
initiator detected error message 231
inquiry command 7, 16, 190, 193
integrity check, partitioning 155
internal-VOLID 121
introduction to 3590 1
invert 202
Invert 207, 208, 209, 211
ISO version 17, 19

L

language 114
last
block location 139
error code 155
error code flags 156
FSC 45
library
attached 18
sequence number 22
linked bit 18, 19
linked command complete
(with flag) message 231
message 231
load command 27
load unload command 7, 26
loader modes 110
locate command 7, 28
log parameter control byte 33
log select command 7, 30, 190
log sense command 7, 32, 190, 196
logical
block input spanning 156
block number 156
block output spanning 156
write protect 155
long 15
LP 43
LP field 34
LU Valid 210, 211
LZ1 99

M

magazine available sense bit 154
magazine cell address 106
magazine lock sense bit 154
mailbox interface errors 67
manual mode, ACF 221
manual mode, cleaning the drive 222
manufacturer device type 18
manufacturer identification 20
maximum
additional partitions 101
block length limit 133
burst size 95
Mchngr 17
media transport element 202
medium
capacity 120
check 155
identifier 115
partition page 1 101
sense 115
type 82, 85, 90
medium transport address 106
message
abort 231
abort tag 231
bus device reset 231
codes, MIMs 45
codes, SIMs 43
command complete 231
disconnect 231
display 18
display type 19
identify 231
ignore wide residue 231
initiator detected error 231

message *(continued)*
linked command complete 231
linked command complete (with flag) 231
message parity error 231
message reject 231
no operation 231
parity error message 231
reject message 231
restore pointers 231
save data pointer 231
synchronous data transfer 231
wide data transfer request 231
microcode
dump available 153
revision level 18
microcode download 6, 186
minimum block length limit 133
mode
ACF, operation 219
pages
X'01' 93
X'02' 95
X'0A' 96
X'0F' 97
X'10' 98
X'11' 101
X'18' 104
X'19' 105
X'1D' 106
X'1E' 107
X'1F' 108
X'24' 122
X'25' 124
parameter header 82, 85, 90, 197, 198, 199, 200
mode select (10) command 7, 79
Mode Select (10) command 198
mode select (6) command 7, 74
Mode Select (6) command 190, 197
mode sense (10) command 7, 88
Mode Sense (10) command 190, 200
mode sense (6) command 7, 83
Mode Sense (6) command 190, 199
model number and device type 18
Move Medium address for drive 106
move medium command 7, 126, 190, 202
MT 108
MultiP 17

N

next-to-last error code 155
next-to-last-error code flags 155
no operation message 231
nominal volume capacity 62
non-medium error count 40
NormACA 17
Not Bus 210, 211
notices 245
number of
blocks 86
blocks in buffer 139
bytes in buffer 139
number of *(continued)*
elements 205
logical blocks in device block 156
MIUs in device block 156

O

Obsolete 19
operation modes, ACF 219
operator panel errors 66
opposite read gap 55
organization ix

P

page code
0 35, 196
02 36, 95
03 38
06 40
0A 96
0C 41
0F 97
10 98
11 101
1D 106
1F 108
20 110
21 112
22 114
23 115
24 122
25 124
31 43
32 47
34 51
36 58
38 59
39 63
3A 65
3B 66
3D 69
list 35, 196
page control 83
parameter control byte, log 33
partition
capacity 121
change command 98
currently traversed, fraction of 62
direction 156
field 28
number 120, 139, 140, 156
size descriptor 103
volume 155
partitioning integrity check 155
PC 88
PC (log select command) 30
PC (log sense command) 32
PC (page control) 83
PER 93
percent capacity 119
peripheral device type 17, 19, 21, 22, 23, 24, 193, 194

peripheral qualifier 16, 19, 21, 22, 23, 24, 193, 194
permanent error 153
permanent write protect 118
Permanent Write Protect 100
Persistent Reserve In - X‘5E’ 127
Persistent Reserve In command 7
Persistent Reserve Out - X‘5F’ 129
Persistent Reserve Out command 7
persistent write protect 117
PERSWP 99
PF 160
PF (mode select 6 command) 74, 79
physical write protect 155
plant of manufacture 18
port behavior with Reserve Unit 158
port busy status 232
position to element 190
position to element command 203
PPC field (log sense command) 32
preface ix
prevent allow medium removal command 7, 130, 190
prevent cartridge 130
priority cell address 106
priority cell element address 202
priority slot address 106
PRMWP 100
product
  and model number 18
  id field 45, 46
  identification 18
  identifier 45, 46
  revision level 20
PS (mode page 01) 93
PS (mode page 02) 95
publications
  3494 ix
  3495 ix
  3590 ix
  additional x
  related ix
PVolTag 205
PWP 155

Q

QErr 96
queue algorithm modifier 96

R

RAC 96
RAERP 96
random mode, ACF 226
random mode, cleaning the drive 227
RBO 98
RDF data acquisition errors 48, 52
RDF/ECC transient condition count 47, 51
Re-Ten 26
read
  backward recovery 53
  buffer empty ratio 98
  error counter page 38
read *(continued)*
  filter coefficients 55
  forward error page 51
  gap misses 57
  retry count 93
  reverse error counter page 40
  reverse error page 58
  Sequential-access drive 41
  velocity errors 52
read block limits command 7, 133
read buffer command 7, 134, 190
read command 7, 131
read element status command 7, 137, 190, 204
read position command 7, 138
read reverse command 7, 141
reader comments 245
ready AEN holdoff period 96
Ready Asynchronous Event Reporting 96
receive diagnostic results command 7, 143, 190, 213
recover buffered data command 7, 145
RED 97
RelAdr 18, 19
related publications ix
relative TOD 113
release command 190, 214
release unit command 7, 8, 146
Report A Check 96
Report Density Support command 147
Report Exception on Decompression 97
Report LUNs - X‘A0’ 150
Report LUNs command 8
request sense command 8, 151, 190, 215
request volume element address 190
reserve behavior for multiple ports 158
reserve command 190, 216
reserve unit command 8, 158
reset
  associated write protect 117
  persistent write protect 118
response data format 17, 19
restore pointers message 231
REW 98
rewind command 8, 159
rezero unit 190
RMB 17, 19
RSmk 98

S

save data pointer message 231
SCCS 17, 19
SCSI commands
  change definition 7, 10, 190
  compare 7
  copy 7
  copy and verify 7
  display message 7, 12
  erase 7, 15
  format medium 7
  inquiry 7, 8, 16, 193
  load/unload 7, 26
  locate 7, 28

SCSI commands *(continued)*
log select 7, 30
log sense 7, 32
mode select (10) 7, 79
mode select (6) 7, 74
mode sense (10) 7, 88
mode sense (6) 7, 83
move medium 7, 126, 202
prevent allow medium removal 7, 130
read 7, 131
read block limits 7, 133
read buffer 7, 134
read element status 7, 137, 204
read position 138
read reverse 7, 141
receive diagnostic results 7, 143
recover buffered data 7, 127, 129, 145, 150
release unit 7, 8, 146
request sense 8, 151
reserve unit 8, 158
rewind 8, 159
send diagnostic 8, 160
space 8, 183
test unit ready 8, 184
verify 8
write 8, 185
write buffer 6, 8, 186
write filemarks 8, 187
SCSI protocol chip errors 66
SDP 102
second error code 155
second error code flags 155
segment number 151
select (10) command 190
select (10) command, mode 7
select data compression algorithm 99
SelfTest 160
send command 8
send diagnostic command 8, 160, 190, 217
send volume tag 190
sense
key specific 152
mode, command 83, 88
mode, commands 7
sequential-access device 41, 42
sequential-device access 41
serial number, drive 18
service message code 44
service message severity code 44, 45
servo
adjust high 54
adjust low 54
data acquisition errors 48, 52
data errors 48, 49, 52
demark blocks read 57
demark blocks written 49
transient condition count 47, 51
setmarks 98, 151
SEW 99
SftRe 18, 20
SILI 131, 141, 145
SIM
and MIM pages 43
flag 153
message codes 43
SKSV 152, 153
small computer system interface (SCSI)
aborts 63
buffer errors 66
bus resets 63
dynamic cleaning indicators 242
port 0 interface errors page 63
port 1 interface errors page 65
protocol errors 63
section 10.4 131, 142
section 8.3.3 131, 142
static cleaning indicators 243
write blocks processed 59
write bytes transferred 59, 60
SOCF 98
Soft Write Protect 99
source addresses 202
source storage element address 207, 208, 209, 211
SP (log select command) 30
SP (mode select command) 74, 79
SP field (log sense command) 32
space command 8, 183
speed 77, 82, 85, 90
ST 108
starting element address 205
storage element address 106, 202
StorXX 108
summary of changes xiii
SValid 207, 208, 209, 211
SWP 99
Sync 18, 19
synchronize to medium 187
synchronous data transfer message 231
SysSet TOD 112
system mode, ACF 225
system mode, cleaning the drive 226

T

tape position indicators 153
Task Set Type 96
TB 93
tension adjust high 53
tension adjust low 54
terminology 246
test unit ready command 8, 184, 190, 218
third party 214
third party device id 214
time-of-day 112
time-of-day flags 112
TMC 43
TMC field 33
TOD 112
TOD flags 112
TOD Reset Valid 112
total
bytes processed 36, 38
corrected read errors 38

total *(continued)*
corrected write errors 36
read errors 38
read retries 56
uncorrected read errors 39
uncorrected write errors 37
unused counter 49, 50
write errors 36
write retries 49
trademarks 246
TranDis 18, 20
transfer length
read command 131
read reverse command 141
recover buffered data command 145
write command 185
write filemarks command 187
transport element address
element addresses 202
transport geometry parameters page 107
TrmIOP 17
TSD 43
TSD field 33
TST 96

U

UAAERP 96
Unit Attention Asynchronous Event Reporting 96
UnitOfL 161
unsupported commands 5
unused counter 55, 57

V

valid 151
vendor identification 18, 20
verify command 8
VolTag 204
volume
capacity 62
control region (VCR)
integrity check 155
read errors 56
write errors 50
currently traversed, fraction of 62

W

WBus16 18, 19
WBus32 18, 19
wide data transfer request message 231
WP 85, 90
wrap half and direction 156
write
buffer full ratio 98
delay time 98
error counter page 36
error page 47
gap misses 50
protect 85, 90, 116, 117, 118
write *(continued)*
protect, logical 155
protect, physical 155
retry count 93
velocity errors 48
write buffer command 6, 8, 186, 190
write command 8, 185
write filemarks command 8, 187
write protect
associated 116
permanent 118
persistent 117
WRTOK 148
WSmk 187

Readers' Comments — We'd Like to Hear from You

IBM Magstar 3590 Tape Subsystem
Hardware Reference

Publication No. GA32-0331-03

Overall, how satisfied are you with the information in this book?

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Overall satisfaction	☐	☐	☐	☐	☐

How satisfied are you that the information in this book is:

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Accurate	☐	☐	☐	☐	☐
Complete	☐	☐	☐	☐	☐
Easy to find	☐	☐	☐	☐	☐
Easy to understand	☐	☐	☐	☐	☐
Well organized	☐	☐	☐	☐	☐
Applicable to your tasks	☐	☐	☐	☐	☐

Please tell us how we can improve this book:

Thank you for your responses. May we contact you? ☐ Yes ☐ No

When you send comments to IBM, you grant IBM a nonexclusive right to use or distribute your comments in any way it believes appropriate without incurring any obligation to you.

Name _____ Address _____

Company or Organization _____

Phone No. _____

Readers' Comments — We'd Like to Hear from You
GA32-0331-03

Cut or Fold
Along Line

Fold and Tape | **Please do not staple** | Fold and Tape

NO POSTAGE
NECESSARY
IF MAILED IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS MAIL PERMIT NO. 40 ARMONK, NEW YORK

POSTAGE WILL BE PAID BY ADDRESSEE

International Business Machine Corporation
Department 61C 9000 South Rita Road
Tucson, AZ , U.S.A. 85741-0001

Fold and Tape | **Please do not staple** | Fold and Tape

Cut or Fold
Along Line

Printed in the United States of America
on recycled paper containing 10%
recovered post-consumer fiber.

GA32-0331-03

Spine information:

IBM Magstar 3590 Tape Subsystem Magstar 3590 Hardware Reference